Lubrication ENGINEERING

JOURNAL OF THE AMERICAN SOCIETY OF LUBRICATION ENGINEERS

2200 Bearings at Compass are Protected by Trabon
Automatically Stopping and Starting with Conveyor, the Mechanically-driven 3400 Pump Needs Only Periodic Filling.

ANOTHER PREPARATION PLANT INSTALLS *Trabon* CENTRALIZED LUBRICATION!

Reduced Maintenance Costs and Better Tonnage Flow at Moss Result in Installation at New Elk Creek Plant.

● Clinchfield Coal's new Compass Plant on Elk Creek has a capacity of 7000 tons of sized and washed coal per day. This new tipple and washery located at Overfield, West Virginia, is completely equipped with Automatic and Manual Trabon Centralized Grease Systems on *raw coal conveyors, sizing shaker screens, washers, cones, etc.*

Trabon's excellent performance following the initial installation at Clinchfield's modern Moss Tipple resulted in the selection of Trabon for centralized lubrication at Elk Creek. Approximately 1500 bearings at Moss were protected by the positive force-feed hydraulically-operated Trabon Systems. These completely sealed systems with single indicators at pumping points permitted feeders and lines to be buried under grime and coal dust.

If you are considering the savings and advantages of centralized lubricating systems either above-ground or under-ground at your operation, write or call Trabon Engineering Corporation today for detailed information.

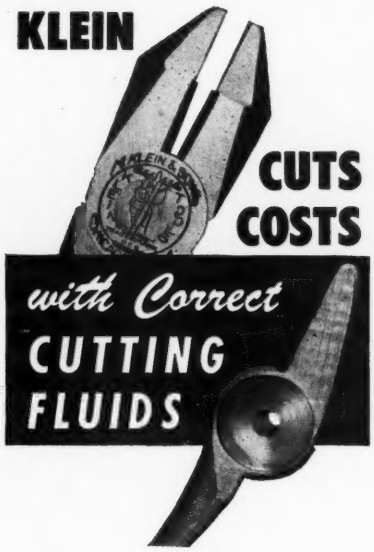
CHECK THESE FEATURES

- ✓ *Trabon is Positive*—Every Bearing Gets Its Full Measured Amount
- ✓ *Trabon is Hydraulic*—Handles Oil or Grease, Using Either Manual or Automatic Pumps.
- ✓ *Trabon Systems are Sealed*—Can be Concealed or Even Buried Under Coal Dust and Grime.
- ✓ *Trabon Has a Single Indicator*—Progressive Feeder Operation Permits Simple, Positive Proof of Lubrication at Pumping Point.

Trabon ENGINEERING CORPORATION

1814 EAST 40TH STREET • CLEVELAND 3, OHIO

Centralized Oil and Grease Systems



MATHIAS KLEIN & SONS, Chicago, selected cutting fluids for machining high carbon vanadium steel forgings for the well known Klein pliers on a basis of competitive tests. When using D. A. Stuart's Solvol, tool life was more than double that secured by the best of several products tested.

With a 20 to 1 dilution of Solvol, side broaching is at the rate of 28,000 pieces per grind. Drilling, reaming and countersinking are done at the rate of 650 pieces per hour with a 30 to 1 dilution of Sclvol.

The increase in tool life and production and the satisfactory finish secured with Solvol on this job are excellent examples of the cost cutting opportunities possible by using the best cutting fluid for the job. In buying cutting fluids it is *wise economy* to figure production costs rather than cutting fluid price. Write for booklet, *Cutting Fluids for Better Machining.*

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2729-53 South Troy Street, Chicago 23, Ill.

Lubrication ENGINEERING

VOL. 5 **JUNE, 1949** **NO.**

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It's time you shackled this PROFIT THIEF!

He's the meanest kind of thief—sly, slick and vicious as they come—stealing profitable production from machines in plants all over the country. But he can be stopped!

Perhaps you haven't even suspected that he works in your plant. Yet, that may be the *very reason* that you should *make sure* that he isn't!

LOOK BEHIND THESE MASKS

Are you still scooping grease from drums to guns by the old-fashioned "hand and paddle" method—wasting time, wasting grease, risking grime and dirt? There's a profit thief at work!

You can save 3¾ man hours for every 100 lbs. of grease.

Are you lubricating machines by hand—the old time-wasting, risky, hit-or-miss way? Watch for *big* losses here!

You can save up to 23.9 man hours in applying each 100 lbs. of grease.

Have you ever counted the losses on "downtime"—production interruptions for lubrication, part failures or replacements due to faulty lubrication? Unmask this thief!

You can lubricate hundreds of bearings from one central point, with the correct lubricant, in the right amount—while machines continue to produce.

Now are you suspicious that a profit thief is working in your plant?

Remember, his disguise is "old time," hit-or-miss, costly lubrication methods that add to the growing costs of production.

There's one proved way to end this needless profit drain!

An Alemite representative can tell you in 10 minutes how Alemite Methods will simplify and better organize your lubrication procedures. He can show you how mechanized lubrication from "barrel-to-bearing" will increase your production and profits.

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THAT CUT PRODUCTION COSTS

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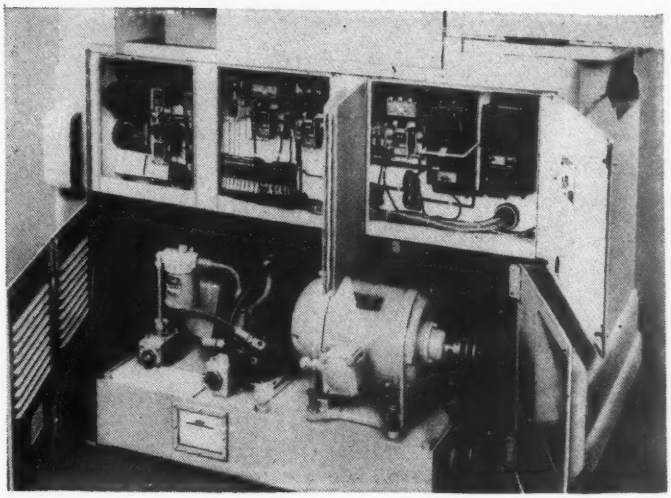
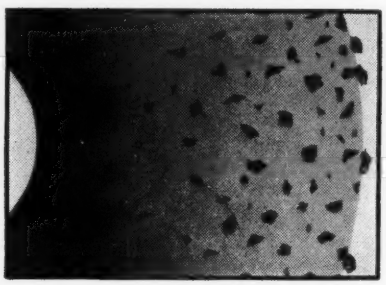
The pumps, proper functioning of the control valves, and pistons in the hydraulic system controlling the automatic cycling and operation of this Heald Machine Company Centerless Grinder and other Heald precision machines, are protected by Cuno MICRO-KLEAN Filters to assure maintaining closest tolerances.



Guaranteed fluid conditioning . . . double cartridge life



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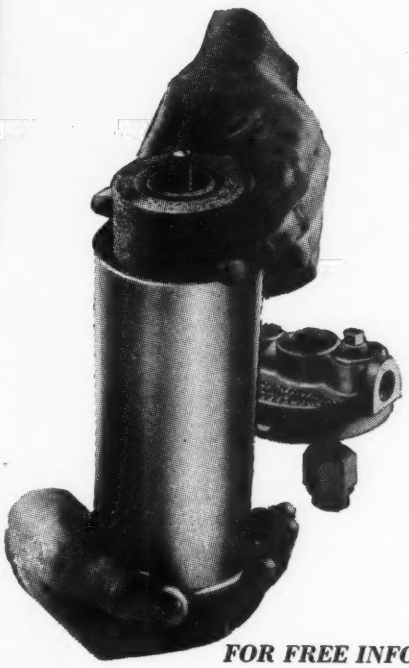
Cuno is the only manufacturer of replaceable-cartridge filters *guaranteeing* to remove all solids larger than specified, plus a large proportion down to 1 micron. MICRO-KLEAN's exclusive "graded-density-in-depth" permits smaller particles to penetrate to varying depths, eliminates surface loading, *doubles dirt holding capacity*. Resinous impregnation and polymerization prevents channeling, rupturing, shrinking and distortion.



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Cuno MICRO-KLEAN filters come in varying densities . . . capacities from a few to more than 800 gpm . . . connections from ⅜ in. IPS to 6 in. flanged . . . single or multiple cartridges to handle full flow. MICRO-KLEAN cartridges fit other makes; special lengths available for built-in installations.

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Removes More Sizes of Solids from More Types of Fluids

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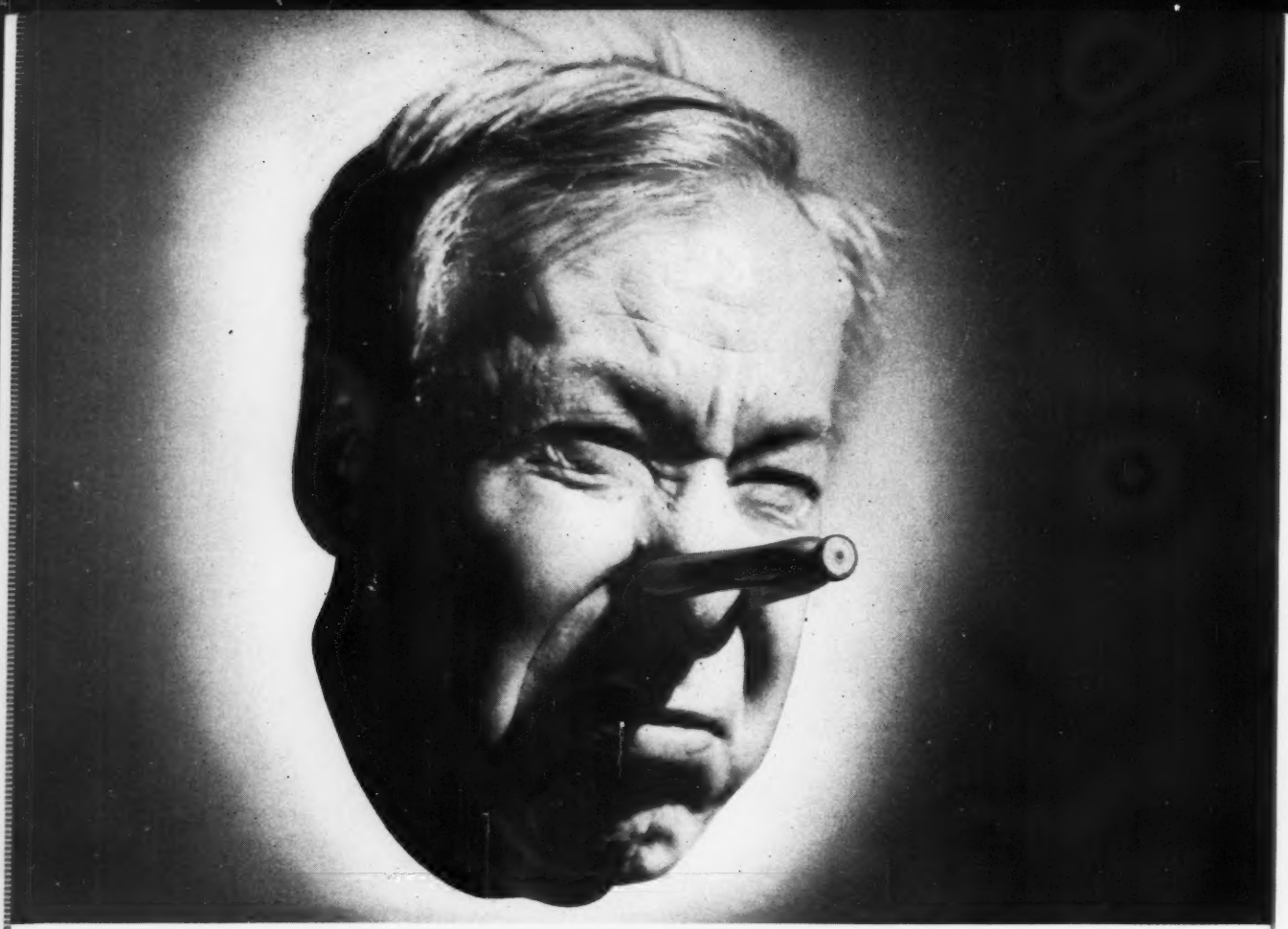

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Every operator in your shop will realize he has a better job when you take the odor out of it. And all you have to do is specify Cimcool.°

Cimcool is the revolutionary cutting fluid that virtually eliminates rancidity even in the hottest weather. It's a *chemical emulsion.* Can't burn. Can't smoke. Has no objectionable odor of its own.

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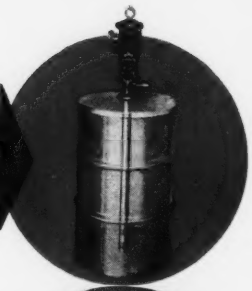
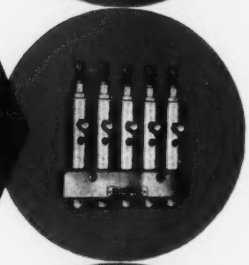
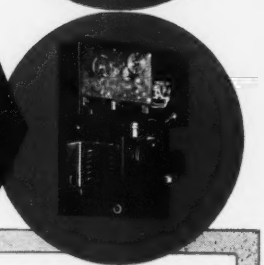


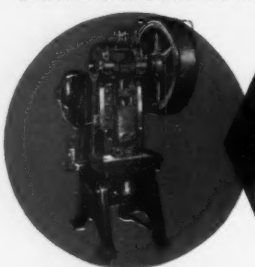
IN THE RIGHT QUANTITY



AT THE RIGHT TIME

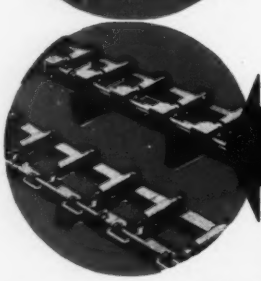


Convert obsolete methods to Centralized Lubrication Circuits



MANUALLY OPERATED

INDIVIDUALLY POWER DRIVEN



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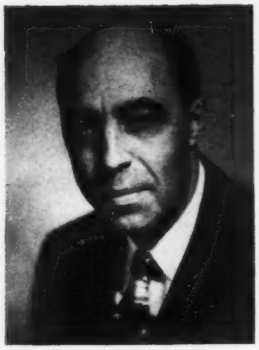

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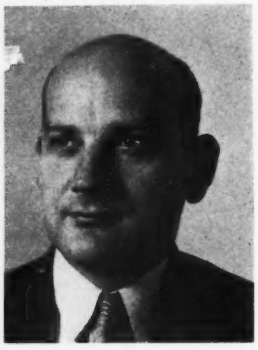

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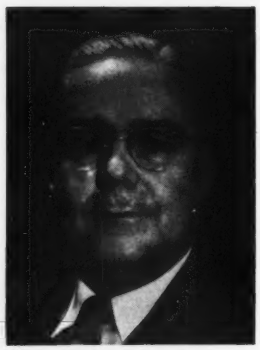

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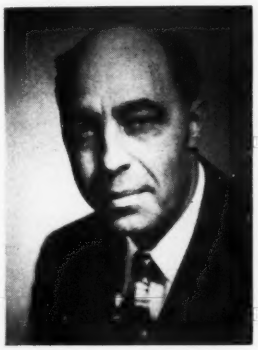

The growth of the A.S.L.E. in four short years is cause for admiration and pride to every member. Our Society was engendered by clear-sighted men and has been endowed with leaders to carry on its business successfully. Our strength is only the sum total of the strength of our individual members. We have not sacrificed quality and interest of our membership in a desire to have a larger group. The individual member has the privilege of furthering the Society's interests by taking an active part in his local Section. These Sections give nearly every member the opportunity of presenting papers, joining in discussions of numerous problems, and furthering his contacts with lubrication engineers, oil suppliers, and men connected with all phases of the lubrication industry. To be identified with our Society is a must for every lubrication engineer. It has been clearly demonstrated that the information needed in this special branch of engineering is appearing in an ever-increasing abundance of material. Our Journal, LUBRICATION ENGINEERING, is the only publication in this country devoted exclusively to the subject of Lubrication. Our Annual Conventions are the only meetings where the subject of Lubrication is dealt with exclusively.

Our Educational Committee, under the able Chairmanship of Dr. Dudley D. Fuller of Columbia University, is rapidly providing texts for individual study. In addition, this Committee is actively engaged in compiling the material necessary for lubrication courses in many of the engineering colleges.

Any Society, in order to carry on its work to the benefit of all of its members, should be balanced according to employment interest. The members of every branch of our industry have something to learn from each of the other divisions and a balance should be maintained between research and development, production, distribution, appliance manufacturers and distributors, and the men who actually handle and apply lubricants in the manufacturing plants throughout our country. We are greatly indebted to our many members in the oil industry for the vast amount of information they are able to bring out at our National and Sectional meetings, for the benefit of our entire membership. We welcome their participation in our work, and I am making a direct appeal to these gentlemen to increase their endeavors along the lines of procuring additional members from industry. They have the acquaintance and the ability to bring to these men the awareness of their need to participate in the meetings, thus gaining the advantage of the other fellow's viewpoint and experience. When a man exposes himself to ideas, he benefits according to his receptivity. We have provided meeting grounds for thorough discussion in 18 key cities in the United States, and at present, have applications from groups in 4 additional cities. This growth of interest in the Society is a natural one that comes from supplying a need. Our whole industrial picture has been speeded up in the last five years. Production machinery has become more intricate and is manufactured with closer tolerances. The fundamental need of proper lubrication supervision, to keep this increasingly efficient machinery in continuous operation, has been fully demonstrated, and the profits of industry depend to a large extent on our ability to keep up steady and uninterrupted production.

For the benefit of our industrial progress, each member should have an application blank in his pocket and whenever the opportunity offers, present it to eligible men. They need the help that our Society can give them and we have an equal need for their new ideas and viewpoints. Only by the increasing growth of our Society can we bring the information necessary to industry, to keep the wheels of progress turning. Our local and national officers will be only too happy to give any assistance within their power, and will welcome any suggestions or constructive criticism that will enable your Society to further serve its members.

C. L. POPE, *President.*

WHAT LUBRICATION MEANS TO MANAGEMENT*

by Granville M. Read

Chief Engineer
E. I. du Pont de Nemours & Co.

GRANVILLE M. READ, Chief Engineer of the du Pont Company, had a leading part in the enormous war construction program undertaken by the Company at the request of the Federal Government. Named manager of the War Construction Division of du Pont in 1941, Mr. Read directed the erection of a large number of ordnance facilities built for the government. In no sense an arm-chair engineer, he spent much time at the sites where his practical experience and his fund of technical knowledge were extremely valuable. He was made assistant chief engineer in 1943 and in that capacity he had supervision of both the design and construction of important war plants. Chief of these was the huge Hanford Engineer Works in Washington, built for the government's atomic energy program. Mr. Read was appointed Chief Engineer of the Company September 1, 1946. In this capacity, he is in direct charge of the Company's post-war construction and engineering research.

Mr. Read is a director of the Remington Arms Company, Inc., affiliated with the du Pont Company; a member of the American Institute of Chemical Engineers, American Society of Mechanical Engineers and the honorary engineering society of Tau Beta Pi.

Lubrication engineers are the guardians of an inconspicuous "mighty midget" which is one of the keystones of modern civilization. Our nation today produces goods worth more than 130 billion dollars and transportation worth more than ten billions. Little of this could be accomplished without the modern lubricants that furnish the minute films that limit heat, wear, and rust where metals are in motion.

Modern American industrial output, which we have come to accept as a matter of course, could not have been reached without lubrication and the ability of lubrication research to keep pace with our progress. Knowledge of lubrication has made enormous strides in recent years. The pocket watch and the steam engine posed early problems on special lubrication requirements. Today, the range in the manufacture of a single product, such as a synthetic fiber, extends from enormous compressors to tiny spindles rotating at tremendous speeds.

For example, take a look at our lubrication problem in the du Pont Company. We make more than 5,000 products ranging from petroleum chemicals and additives to synthetic fibers, from paints to explosives, from plastics to fine perfume and hundreds of other things. The equipment necessary to make these products includes almost every type of process apparatus. We have to operate all kinds of rolling stock, delicate precision tools, heavily loaded crushers, construction machinery, automotive, diesel and gas engines, huge compressors operating under thousands of pounds pressure, and many special machines that are required in the chemical industry. This equipment must operate under a wide range of mechanical and chemical conditions.

A momentary failure means lost production. Not so long ago it did not make too much difference. Machines operated at slow speeds and continuity was not important. We could make up a production loss by running a few extra hours. But now things are different. Machines today are designed to run with minimum down-time, and when we lose production we seldom can make it up. We depend on modern lubrication and lubrication engineers to keep our machines running.

The progressive manufacturer realizes that to produce the goods he must spend money on lubrication. He is vitally interested in it from two standpoints: first, as an essential key to uninterrupted production, and, second, the cost, which is not to be taken lightly in these days of keen competition. For example, lubrication costs the du Pont Company about 2 million dollars a year.

Functions of the Lubrication Engineer

Applying today's knowledge of lubrication throughout a company is no simple task. Specific individuals must be assigned to gathering and applying this knowledge and they must be so fitted into the organization that they can do this job effectively. The set-up in the du Pont Engineering Department for fulfilling these responsibilities is handled on the following basis:

The field of the lubrication engineer naturally divides itself into three broad phases, each to be performed with due regard for economy:

1. Machines and equipment must be *designed* for adequate lubrication and for the proper application of lubricants.
2. The proper lubricants must be *purchased* and suitable inventories maintained where needed.
3. The correct lubricant must be *delivered* at the

*Paper presented at 4th Annual Convention of A.S.L.E., New York City, April 12, 1949.

proper time and in proper quantity to the particular spot at each machine throughout the manufacturing areas.

Design

First, consider the equipment-design activities of the lubrication engineer. Designing of equipment for adequate lubrication is profoundly influenced by the competitive nature of our economy. For instance, the manufacturer of the electric refrigerator in our kitchen knows it is unrealistic to expect the ladies to pay any attention to its lubrication. So he builds in sufficient lubrication to last the life of the machine. At the other extreme is the highly specialized equipment used by the chemical industry. Lubrication is unlikely to be recognized as the cause for failure of chemical process equipment. So the purchaser needs to have lubrication engineers to study the machinery to make sure there is suitable provision for lubrication.

Logically, such men should be in the company's engineering organization as they can thus work conveniently with the design engineers as well as with the men who are responsible for buying the equipment.

Purchasing

Second, consider the relationship of the lubrication engineer to purchasing. Purchasing lubricants, specifying the correct grades, and making the right quantity available where and when needed is in itself a major field. At least three distinct steps in purchasing are required of the lubrication engineer:

1. There should be an evaluation of the lubricants necessary for each machine to be operated, together with an estimate of annual consumption.
2. Lubricant requirements should be consolidated so that a minimum number of grades and kinds may be kept on hand.
3. A guide should be established for the purchasing agent, to make sure that purchases conform to requirements.

In the procurement of lubricants, the engineer and purchasing agent must cooperate to keep things under control. We are all aware of what excess inventory stock will do to a business. Lubricants are no exception.

A few years ago a large plant, about to go into operation, was found to have on hand 300 barrels and 95 different varieties of lubricants. Included were a dozen barrels of elevator guide rail grease—enough to run the two elevators in the plant for years! A lubrication engineer subsequently specified a dozen types which would meet all needs. He cut the inventory to one-sixth its original size.

Application

The third major function of the lubrication engineer is lubricant application. This means simply to get the right lubricant to the right bearing in proper quantities at the right time and with the least cost. Failure to do so will mean a breakdown of the complex sequence of steps which a chemical product goes through in the manufacturing process. The failure of a single link in the chain may curtail production by many tons.

So, any company which hopes to keep its maintenance costs down and its production up cannot afford to be without the services of capable lubrication engineers. Problems in a large plant may justify such men on the local staff. Where several plants are served by a central engineering organization, the lubrication experts should preferably be in that group. They need a variety of skills and experience. The application phase alone falls into three distinct categories:

1. The lubrication engineer must establish routines for scheduled lubrication of each machine. These routines aim to make sure that nothing is overlooked.
2. He must handle trouble-shooting as required.
3. He must search continuously for ways to improve production and quality by better lubrication.

The cost of application should have been taken care of to a large extent in the design stage. However, there always remains the problem of keeping lubricating appliances adjusted to the correct delivery rate and of maintaining enough lubricants in it. Also, there are always some machines which require manual attention. This means scheduling.

Planning and Scheduling

We find that proper planning and scheduling not only increases production by avoiding machine outages, but also reduces lubrication costs at least 10 to 15 per cent.

For example, in one of our plants there are 2,750 machines, including pumps, dryers, ball mills, kilns, and many other pieces of chemical process equipment. To lubricate them required more than 1,500,000 inspections a year. After we inaugurated lubrication scheduling, we were able to cut the number of inspections to about 1,200,000—a drop of about 20 per cent. This resulted in savings of several thousand dollars in application costs. But, in addition to that, the number of equipment failures was curtailed. In one of our machine shops, several thousand dollars were saved through proper scheduling. The year before scheduling was installed, more than 200 repair orders were issued due to lubrication failures, or in some cases, the absence of lubrication. In the year after scheduling was installed, there was not one failure due to these causes.

Trouble-Shooting

Trouble-shooting can really test the skill of the lubrication engineer. For example, in one plant we tried to increase the speed of certain machines about 20 per cent to get more output. Trouble developed in the form of rapid failure of oil-immersed gears. Making a comprehensive analysis, our men traced the cause to "hunting" of the drive motors and this, in turn, to the turbine governor in the power house. Changes made to the governor stopped the rapid failure of gears and allowed the machine to run at higher speed without excessive maintenance costs. Being able to run the machines at the higher speed avoided the need for a large capital investment.

Production and Quality

The lubrication engineer needs to be up-to-the-minute on new developments in his field. There is always something new coming along which makes the "impossible" of a year ago into the "routine" of today. This was the case, for instance, with the development and use of suitable lubricant additives which eliminated high-pressure compressor valve fouling, which for many years was regarded as inevitable.

He must also be concerned with quality of production as well as volume. This does not mean that he

should simply see that the machines continue functioning smoothly, but he must see to it that the lubricants do not interfere with the products of those machines. Chemical reactions can be changed by minute amounts of lubricants in the wrong places and products can be stained or discolored or otherwise damaged the same way.

One of the worst things about poor lubrication is that it creates hazards in the plant. Equipment which is not properly maintained is unsafe for employees and it automatically creates a safety hazard. Lubrication engineers can do much to eliminate unsafe working conditions and at the same time create operating savings. In one case, open bevel gears were throwing lubricant to the aisle, creating slippery footing for the operators. Development of a new and more adhesive lubricant solved the problem, eliminated the safety hazard, and also effected substantial savings.

Installing a Lubrication Program

The problem of installing a thoroughgoing lubrication program is similar to that of establishing a safety program, which is now recognized as a necessity by all progressive companies. Such a program in the du Pont Company has resulted in a rate of less than one accident per million exposure hours as compared with a national average of 14 accidents per million hours for all industry.

Lubrication engineering, like safety, must be sold from the top down rather than from the bottom up. It must be directed from the central office by management, which must insist on sound lubrication practices. The lubrication engineer can make very great contributions. Why, then, do so many manufacturers attempt to operate without him?

Perhaps the first difficulty in convincing management of the need for expert help is the time-lag between cause and effect. You walk past a machine in the shop, noting casually that the oil cups are empty. Only comprehensive statistics could establish a relationship between such carelessness, the per cent rejects due to wear, and eventual cost of overhauling the machine.

Another difficulty in establishing the need for help is the question of cost. When a lubrication engineer is hired, his salary shows up immediately. But it is probably several months before he can report even that inventories have been cut down. How about purchasing costs? The accounting costs? The effects on the power bill, the repair bills?

Clearly, lubrication is a matter in which management must proceed on general principles. Just like safety, the company president must make sure there are competent men on his staff, with adequate prestige and authority, then go ahead with it. Then, and not until then, the rest of the organization will fall in line.

Summary

Before closing, let me summarize the point that American management must be brought to understand about that "mighty midget," proper lubrication, and its guardians, the lubrication engineers.

Modern industry is based on intricate processes and complex, heavy-duty machines. Friction and wear must be minimized to keep output up, and costs down. Keeping friction and wear at permissible levels requires modern lubricants properly applied. Research on lubricants is wasted unless the lubrication engineer can aid the designer of machines to take advantage of the new products. Good lubricants and machines designed for proper lubrication can be brought together if the lubrication engineer guides the purchasing agent. Reduced output and high costs due to excessive wear and friction will be avoided if the lubrication engineer is allowed to make sure the right lubricant reaches the right spot at the right time.

Lubrication engineers have ahead of them a big task of education. The oil industry plows back large sums in research to make improved lubricants. Lubrication engineers must show American management how to buy and use these new keys to mass production. Lubrication engineers must apply new lubricants to improve still further our standard of living by increasing the output of our farms and factories while decreasing production costs.

Introductory Remarks by B. G. Symon

Shell Oil Co.

There is shaping up such a thing as a philosophy of lubrication. That is what Management is interested in because this philosophy covers the principles which govern sound lubrication practice. Let me point to a few of these principles which I hope will be thoroughly discussed during this symposium.

Sound lubrication engineering requires sound lubrication knowledge. This knowledge can only be developed by establishing close teamwork between the equipment manufacturer, the consumer, the lubricants supplier, the supplier of lubrication devices and last, but not least, the contributions of science. The same close cooperation is necessary between technical societies interested in lubrication such as the A.S.L.E., A.S.M.E., A.S.T.M., S.A.E., N.L.G.I. and the Lubrication Committee of the A.P.I.

Another principle which is being increasingly recognized is the selection of lubricants on the basis of performance rather than specifications. Specification buying is often synonymous with price buying. Performance buying, however, means buying of lubrication rather than lubricants, whereby lubrication as production insurance includes such factors as product research, technical service, in short the good will of the supplier's brand. In other words, modern lubricants are made to fill a need for economical lubrication rather than cheap lubricants.

Finally, a new principle in the application of lubricants has recently been established and is spreading fast. This is the principle of multi-purpose lubricants. Not many years ago, the consumer demanded and the lubricants manufacturer supplied so called "tailor-made" lubricants, often developed to meet certain performance requirements of one special piece of equipment. The necessity of numerous purchases of relatively small quantities, excessive inventories and the ever present hazards of mis-application suggested a change in this practice. Now it is known that often one or a very limited number of high quality lubricants can be used to lubricate a great number of different types of equipment. As a result, the purchasing as well as lubrication procedure can be much simplified and lubrication economics improved. Although the unit cost of the multi-purpose lubricants may be slightly higher than the average cost of a great number of different and in part tailor-made lubricants, from the storage, application and maintenance point of view the development of multi-purpose lubricants represents improved plant economics and industrial progress.

We all know that neither the lubricants supplier nor the equipment manufacturer nor the consumer are unselfish. In a free economy they work toward one end, namely, maximum profit. Yet they all know that only top performance of the lubricants insures trouble-free plant operation and in this respect they have one joint interest in mind, namely, to cooperate for the ultimate purpose of making foolproof lubrication available.

Discussion by E. Crankshaw

Cleveland Graphite Bronze Co.

Mr. Read is to be congratulated on his excellent paper in which we concur with him that the Lubrication Engineer is an absolute necessity in any large industrial organization. He has very thoroughly explained the duties and the value of having a lubricating engineer in our organizations by,

1. Establishing procedure for proper application of the lubricant.
2. Suitable lubricant inventories.
3. Scheduling lubrication.

4. Advising in the purchase of proper lubricants.
5. As a design consultant on lubrication.

In the application of such materials it is not uncommon to find in many organizations that management permits everyone in the organization, even the machine operator, to specify the lubricant to be used on a given process or operation, with the result that everyone is in a constant state of confusion with lubricants being tried and discarded without any improvement in the process or products. The cost of such a procedure is usually hidden, and management is not aware the money is being wasted. It is our opinion that a Lubrication Engineer, to be most efficient to management, must be capable and have the authority to specify the type, not the brand name, and the method of application of the lubricant and coolant to be used in a given process.

In testing new lubricants, the engineer must be capable of distinguishing between types of lubricants, as it is a waste of time and money to set up an elaborate testing program on a series of oils or coolants of the same general type when the nature of the operation requires a lubricant of an entirely different composition.

As Mr. Read has pointed out, the Lubrication Engineer must be able to assist the Purchasing Department in buying of lubricants. However, if the type and quality of a product is adequate for performing its intended function at a high level of efficiency, it should be the Purchasing Department's prerogative to select the brand name or source of supply.

In reading this paper we were particularly interested in the statement that the lubricant must be delivered in the proper quantity to a particular spot. We all know if an insufficient amount of lubricant is delivered to a bearing, excessive wear or seizure may result. On the other hand, excessive heat may be created, resulting in high horse-power loss if too much oil is passed. We have been using oil flow theory tempered with extensive field experience in calculating the amount of oil which should be supplied to a bearing, and we are convinced that this information is not infallible. It is hardly fair to expect an answer here, but there are many engineers in this country who would like to know how much oil to supply to a bearing under a certain set of conditions of design and operation.

Discussion by L. A. Danse

General Motors Corporation

This critical disquisition of Mr. Read's gives a masterful exposition of the importance of the function of the membership of our Society and he is to be congratulated for the force and clarity of his explanations. All this is witness of his command of the subject and his thorough familiarity with all aspects of lubrication engineering.

Lubrication Engineering is the front rank of the first line of defense in Maintenance; as it is the keystone of Preventive Maintenance. The old saying that "an ounce of prophylaxis is worth a pound of therapeutics" is all too true in industry; so that lubrication is the most important function in maintenance.

Mr. Read well brings out and develops this reasoning in his paper. Management should reach this conviction with only a cursory consideration of the subject and must be impelled to this conclusion upon acquiring any grasp of the subject.

His citations of the great range of problems existing in the chemical engineering industry indicate that maintenance cannot function, and repairs will become the function if the above reasoning is ignored.

Down-time is anathema to management and nothing will "keep 'em rolling" without proper lubrication.

Since the dollar sign is in the upper left-hand corner of every piece of paper we handle, our costs cannot be what they should unless preventive (not repair) maintenance is the rule; and this is impossible save by virtue of organized and scheduled lubrication.

The lubrication man, in this sort of plan, becomes the policeman of the equipment and exercises a benevolent tyranny over the shop; so that the machine repairmen, electricians, millwrights and other mechanics are constantly alerted concerning potential troubles.

In procurement and utilization of lubricants, the planned and scheduled organization of lubrication for preventive maintenance will be reflected in simplification, reduction of inventory, reduction of error and reduction of labor; with accompanying decrease of cost.

Since so much can be accomplished by the lubrication man —the policeman—trouble shooter—it behooves management to select the lubrication staff with the utmost care. To properly function in the preventive role, the people who do the actual oiling and greasing should be the top-flight mechanics of the machine-repair staff. It is preposterous to tell a sweeper to lay down his broom and grab an oil-can. To do this, is to lose sight of the possibilities of preventive maintenance. The better mechanic the oiler is, the more certain it will be that the machinery will be taken care of.

Shipping executives have long recognized the important place occupied by oilers, and their "black gangs" in the ship's engine rooms long ago ceased to be "black gangs" and became staff people in the "engineering" of the ships. In the oil-fired or oil-powered modern ships, the Navy carefully selects the personnel doing lubrication. A fireman works four months before becoming an apprentice fireman where he does limited oiling under close scrutiny and supervision of better qualified ratings. After six months more time, an apprentice fireman takes an examination to prove proficiency, after which he does general lubrication. After nine more months he may become fireman first-class, when he is entrusted with lubrication of a group of equipment, still under close supervision. As Machinist's Mate Third Class, then Second Class, he acquires more responsibilities but not until he rates Machinist's Mate, First Class does he become a lubrication supervisor and only upon achieving Chief Machinist's Mate is he classified as Lubrication Engineer. This means that not until he has served faithfully for 15 months in intimate contact with the equipment is he trusted to handle the lubrication of a group of auxiliary equipment, and not until two years service does he get any responsibilities.

How different from our plant, where we grab a broom from a fellow's hand and stick an oil-can into it. So we are not only vitally concerned with the lubrication engineer, who plans, schedules and supervises the program in the plant, but also with the people on the firing line who carry out the policy and execute the program. These people are the preventive maintenance policemen and if they do not carry out the terms of the program, the whole thing is ineffective.

Accordingly, these public safety officers of the industrial equipment should be carefully chosen, with diligent and solicitous care as to their qualification not only to pour in the oil and grease, but to get "the right amount of the right lubricant in the right place at the right time;" and, more to the point, to recognize potential trouble and get it taken care of before it develops.

Let's do our lubrication so we forestall breakdowns and keep the line going.

Only thus can we justify our trust and fulfill our obligations.

"Oil is cheaper than machinery. Let us use it wisely." And while doing so, let us observe the equipment under our care and so perform the most important function of preventive maintenance.

Discussion by D. N. Evans

Ass't Gen'l Master Mechanic, Inland Steel Co.

What lubrication means to management—is dollars in the pocket—a most important phase of good management! A lubrication engineer can do all the things Mr. Read has enumerated for any company that will recognize that possibility.

I am particularly interested in the statement he has made that reads as follows: "Lubrication engineering, like safety, must be sold from the top down rather than from the bottom up." That is "Step A" in any program. "Step B" is a lubrication engineer with as much authority as he has responsibilities.

We have found in the Steel Industry that good lubrication not only puts dollars in the pocket, but also provides an unparalleled training ground for good maintenance men. In our case, several men formerly in charge of lubrication in their departments are now in charge of all mechanical maintenance in those departments. Their rise was rapid and the future is bright for these men because their background is good and the detail of the lubrication assignment makes them well founded in the knowledge and experience necessary for the higher job.

The Purchasing Agent, Chief Engineer, Master Mechanic and Department Superintendents all have much to gain if they will believe in and use the services of the Lubrication Engineer who is backed by management.

Mr. Read is to be complimented on his interpretation and presentation of a very important subject.

Discussion by Oscar Frohman

Consulting Engineer, Ampco Metal, Inc.

It has been a pleasure to listen to Mr. Read's very important contribution to this convention.

He speaks by virtue of his experience and position with considerable authority.

The subject matter is timely and must be seriously considered by everyone who has managerial responsibilities in Industry. Even if Top Management is not sufficiently informed to be aware of the importance of correct lubrication, then Assistants should take it upon themselves to see that proper attention to this matter results in the installation of an adequate lubrication system. However, just installing is not nearly enough. The proper administration and functioning are very important. As Mr. Read so aptly pointed out that the expenses of a lubrication system are immediately apparent, but the actual results may be longer before becoming evident. This factor alone requires careful handling, so that it can be demonstrated to responsible officials that the addition of an adequate lubrication division to any industrial organization is a real dividend paying investment. It is an insurance policy against breakdown, costly repair bills, inefficient operation and loss of profits.

A Lubrication Engineer, capable of heading his departments, must be a versatile person, indeed. He must have sufficient stature to command respect, not only of those under his direction, but more important, of those above him. He must prove his ability to save, so that he will be automatically consulted concerning the acquisition of new equipment before such is purchased. He must be able to make definite recommendations concerning the adequacy of lubrication, to insure satisfactory, trouble free operation of all types of equipment. For all kinds of machinery from wheelbarrows to complicated automotive vehicles, from simple chain hoists to complex elevator systems and cranes, from grindstones to involved machine tools, from common hand drills to intricate measuring instruments and meters, to turbines and involved hydraulic systems, in fact, to everything that slides or turns, is the Lubrication Engineer responsible for top performance. One begins to see that a good Lubrication Engineer must be a well versed individual. He certainly should have a good engineering education and a lot of practical experience. He must know materials of engineering. Ofttimes a failure is blamed on faulty lubrication when, in fact, improper material specifications by designers was at fault. Then again, often inadequate lubrication provisions result in failure. Sometimes expert diagnosis prescribes different material plus a revamping of the lubrication system, which combined result in satisfactory operation. But the real truth often also lies in the fact that if the lubrication had been as good originally as the revised system, failure would not have occurred.

A good lubrication engineering division in a plant can, by means of testing, routine and experience, and if placed in full charge of lubrication, practically predict the operating schedule of any given piece of equipment. I was glad to note Mr. Read's reference to the matter of providing proper information to the purchasing departments. I think that should even precede the purchase of the lubricants themselves. The equipment or machinery bought needs very careful specifications so as to conform to the standards required by the Lubrication Engineers for proper operation after delivery into the plant. It is really rather surprising that new machinery delivered from reputable and well established firms often leaves so much to be desired when it comes to lubrication provisions. Too often I have seen supposedly first class equipment lacking in some essential lubrication provision, so much so that a lot of time was wasted in revamping the system so that even minimum requirements could be met. That sort of thing is all so unnecessary and could easily be eliminated if a capable lubrication engineer were consulted, and this has to be done when a machine is on the drawing board and not after it is delivered. I, for one, would like to express my appreciation to Mr. Read for his very fine paper. This cannot help but be very influential in not only giving some managers a very valuable tip, but in its broader sense bring to the attention of both management and the Lubrication Engineering Profession the realization that by working together, the best results for the benefit of both can be obtained.

Discussion by C. C. Goehring

Esso Standard Oil Co.

Mr. Read's statement that any company which hopes to keep its maintenance cost down and its production up cannot afford to be without the services of capable lubrication engineers is especially noteworthy. In the last decade leading manufacturers in almost all industries have become increasingly aware of the importance of lubrication, and the direct bearing this science has on plant economy, safety and production. Experience has indicated that one of the best means of realizing these advantages is to employ trained lubrication engineers, and to give these individuals sufficient responsibility to carry out their assigned tasks.

As in all other fields, the efficiency of lubrication engineers is primarily dependent upon individual training, background, and ability. In this regard, the American Society of Lubrication Engineers is of great service to industry by partaking in the training and by promulgating information dealing with lubrication.

One advantage of having an individual assigned to lubrication in a given plant not mentioned by Mr. Read is the simplification of solicitation by oil suppliers. Previously, it was frequently necessary for a sales representative soliciting business with an improved product to approach foremen, maintenance superintendents, etc., in each department and arrange for individual tests. With a lubrication engineer on the site, the sales representative can work with the lubrication engineer directly and let this individual arrange and follow performance tests. This procedure, of course, saves time and permits the experimental program to go on without major disruptions.

Plant lubrication engineers are also in a position to serve the oil industry by providing valuable performance data on experimental lubricants. As you all know, lubricant development in petroleum research laboratories usually terminates when the product under consideration has passed laboratory tests. Beyond this point field tests are necessary, and we rely to a very considerable extent upon the judgment of potential customers. Field tests under the close supervision of competent lubrication engineers are especially valuable and through the close cooperation of plant and oil company lubrication engineers significant improvements have been realized.

Mr. Read mentioned a figure concerning the cost of lubrication to his company. I would be very interested in learning what procedure was used in preparing this figure. Strictly speaking, the cost of lubrication embraces many factors besides the cost of lubricants as such. The cost of application, storage and purchasing should be included, as well as bearing replacements which can be attributed to the lubricant employed or the frequency and method of its application. The latter figure, of course, is difficult to calculate and we wonder if your figure includes a provision for this item.

Discussion by T. D. Jolly

Vice-President in charge of Engineering and Director of Purchasing, Aluminum Company of America

Mr. Read has presented a very fine and timely paper. In these days of high prices, it is necessary for all industry to reduce costs as much as possible. Sometimes, however, money can be saved by spending money. Illustrating this thought, Mr. Read points the way to good dividends from investments in competent lubrication engineers. Scientific lubrication will reduce:

Power requirements,
Maintenance costs,
Idle machine time,
Safety hazards,
Inventory of lubricants,
Quantity of lubricants used.

In any plant that uses machinery, these savings should make possible lower unit costs.

If we look back just a few years, it is not surprising that some organizations have failed to keep pace with the tremendous developments in the science of lubrication. Not too long ago, greases and oils were sold by salesmen who had a good line of patter, but little knowledge of their product and its uses. Application of lubricants was left to pensioners who had been crippled or had grown old in service. Purchasing, or at least the specification of what to purchase, was the responsibility of the department superintendent, the foreman or the oiler himself.

It is only in recent years that the manufacture and use of lubricants has actually become a science. This assertion is supported by the fact that you are now holding only the Fourth Annual National Meeting of the American Society of Lubrication Engineers. Although your youthful society has accomplished much in its short life, there is still more to be achieved before the lubrication engineer is accepted as an industrial necessity.

Traditions die hard. Many organizations that are still in the greaser and oiler stage will find it difficult to recognize that lubrication is a science. Papers like Mr. Read's, however, can play an important part in breaking down this resistance to change. By serving to broadcast such important information throughout industry, your Society will gain prestige. Through your efforts, lubrication will eventually attain its proper status in industrial life.

Discussion by W. P. Kuebler

Westinghouse Electric Corp.

The Program Committee has provided the writer the opportunity to discuss Mr. Read's paper and he is to be complimented on his presentation of management's viewpoint.

A.S.L.E. has very definite aims and purposes and as chairman of the Philadelphia Section I am pleased that "managements" are appreciating the value of the Lubrication Engineer. I do know, however, that Mr. Read's company is not a recent convert, but one of the leaders in the field.

A.S.L.E. has before it the tremendous task of "selling" the Lubrication Engineer to managements in general and in our short existence we have made tremendous strides but still have a big job of selling. Backing from such firms as du Pont will aid us in a very great measure.

In our Philadelphia Section we are securing the interest of more and more firms; many have Lubrication Engineers assigned, but it is going to take these fellows some time, as Mr. Read states, before they will be able to earn their "salt" by reduced inventories, purchasing cost, power and repair costs and last but by no means least, a reduction in the number of lubricants stocked.

Mr. Read's example of a reduction in inspections with the resultant savings through the proper use and application of lubricants is very informative. I believe too many plants still use too many lubricants; the employment of a Lubrication Engineer can and will reduce these without sacrificing performance or without producing harmful effects.

Mr. Read tells us of one of his plants where they have 2,750 varied pieces of machinery and equipment. At our South Philadelphia plant we have slightly over 4,750 pieces of machinery, including turbines, diesels, pumps, large overhead cranes, and machine tools ranging from light high speed precision tools up to large planers, lathes, boring mills, gear hobbers, etc., capable of handling castings and forgings weighing up in the tons, and even on these large machines we look for and secure precision work.

The lubrication of this large variety of machinery and equipment is taken care of by only ten regular lubricating oils and five greases. The oils range in viscosity from 60 sec. S.S.U. at 100 F to a heavy cylinder oil of 4000 sec. S.S.U. at 100 F. and all are rust inhibited or proven to be rust inhibitive in their characteristics. In addition we find use for three more or less special "additive" oils, containing E.P. or special oiliness characteristics, where special machining problems are encountered, for example, short strokes on very large heavy duty planers and on some special gear hobbing operations. These special lubricants are also used in certain shop processes, so while they are lubricants, they serve in ways other than as actual machine or equipment lubricants.

Our system provides our Purchasing Department with anywhere from two to ten or more sources of supply for any lubricant we use, any of which will provide us with a satisfactory lubricant to do a satisfactory job; and gives them a guide to make the most satisfactory purchase at the time our Stores Department places the requisition.

There is no doubt in the writer's mind that we can further improve our over-all lubrication picture, however, we do point out that the elimination of many different grades of oil can be accomplished without sacrificing proper lubrication.

Discussion by T. A. Marshall

Lubrication Supervisor,
Steel Co. of Canada, Ltd.

Mr. Read, in his paper, has given us a very comprehensive picture of "What Lubrication Means to Management." Present-day lubrication problems are a far cry from the lightly loaded, slow moving mechanisms which ante-date the development of the steam engine, electric motor, and internal combustion engine.

Animal and vegetable fats sufficed for a time when the men who operated machines were virtually all skilled mechanics. They not only operated the machines, but lubricated them as well. Therefore, plants had skilled men lubricating equipment.

A great many of you present will recall that, shortly after World War I, many companies found it advantageous to centralize the maintenance of machine tools. This led to a most unfortunate situation in many plants. The job of oiling machinery was established as a low skilled and low paid vocation—in some instances only a jump ahead of a sweeper. Therefore, there was no incentive for a good man to apply himself. The cost to industry of neglecting this important function is today buried in the maintenance and production costs of a business. No small part of the high cost of manufacturing merchandise today is due to the lack of trained personnel within the industry to carry on the important function of lubrication.

In the past, plant supervisory staffs have depended on the machine manufacturers' recommendations, and the oil company engineer, for their lubrication guidance. The oil company representative at best can only spend a small portion of his time with any one industry, and is usually not present when the lubricant fails, or the critical breakdown occurs, while the equipment manufacturer, in many instances, only makes very general recommendations, as operating conditions are rarely the same, even in two mills turning out identical merchandise.

Twenty years ago, lubrication offered no great problem because no one paid any attention to it. Up until that time, as far as steel mills are concerned, no one had delved into the many grades and composition of lubricants. It is only in comparatively recent years, when the advent of high speed machinery made it necessary, that some one with knowledge gained in the study of the performance of lubricants devotes full time to their selection and application.

Research Chemists of the oil industry have given us innumerable products from petroleum, and are constantly developing new ones to meet changing conditions. To take full advantage of these new lubricants requires a lubrication engineer full time, with a trained staff to carry out his directions and policies.

Discussion by C. L. Pope

Lubrication Engineer, Eastman Kodak Co.

Mr. Read and the DuPont Company are to be commended for the study and thought given to lubrication in a modern industry. The author has covered the subject so well in this one paper that little is to be added if one thinks through the job conception as presented in this paper.

It might be well at this time or possibly it is a subject for another paper to consider lubrication development work by the lubrication engineer. Modern industry must develop new ideas, adopt new ideas at an early date or necessarily suffer in competitive business. To some of us, the excellent work done by the lubrication engineers in the field of original research, cooperative testing with responsible technical committees, and the free interchange of mutual experience has helped tremendously in the adoption of approved testing procedures, standards of performance to be expected, and overcoming lubrication difficulties. It is apparent to us that Mr. Read's management recognizes this responsibility of the lubrication engineer as they have contributed generously in this field of endeavor.

Mr. Read has shown that where management sets up a program, with a good analysis of the job scope, staffs the service according to its needs, and lends support to the program that the cost reductions are very real where lubrication is a factor in the cost.

An industry gains another important advantage when management takes an interest in lubrication. The specialized individuals in the organization have an opportunity to receive from the oil producers the information of the most importance to a particular industry. The oil producers are equipped with highly trained specialists and with adequate research equipment. This talent can be used to great advantage when people are equipped to understand a problem so that it can be presented properly.

The writer apreciates the opportunity of offering these comments on Mr. Read's excellent paper.

Discussion by C. E. Pritchard

Chief Lubrication Engineer, Republic Steel Corp.

Lubrication engineering in the steel industry has grown in scope of coverage through the years to a point where the actual selection of the correct lubricant for the application in question is but one of the phases involved.

Of equal importance is the need for adequate coverage in the selection of the proper type bearing material to best meet the conditions encountered, methods to be employed for the application of the lubricant, maintenance of the lubricating equipment to insure that same is in an operative condition at all times, standardization of fittings and dispensing equipment to permit a reduced inventory, development of the most economical processing lubricants for various manufacturing operations, development of the correct type of protective coatings preparatory to shipment of the manufactured product, reclamation of used oils, rehabilitation of bearings to permit extended service life, development of protective coatings for spare parts or machinery not in service and training of maintenance per-

sonnel as to the best recommended lubrication practice as an adjunct to preventive maintenance.

Each and everyone of the items mentioned above bear a direct relationship to basic economy in the operation of the present-day steel plant. As such they must be given due consideration and the necessary follow-up in order to obtain the economies involved.

Proper selection of the correct bearing material for the conditions encountered in the field invariably increases the time availability of the machinery with higher production yield per man hour resulting. It is needless to say that extended bearing service life offers an additional savings in the purchase price per unit of production.

Higher speeds incorporated in modern design of mill machinery introduces added problems from the standpoint of lubricant application during the operating cycle. Extended usage of intricate mechanism as a function of control also tends to make the attendant problems regarding application of the lubricant more and more complex. Installation of semi-automatic or automatic lubricating devices has been found to be mandatory in meeting these requirements.

The problems encountered with the initial semi-automatic or automatic lubricating system installations indicated a definite need for setting up lubricating system repair stations if their full value was to be realized. It might truthfully be said that in most cases they were found to be more of a liability than an asset due to our lack of knowledge and mishandling rather than their inability to perform the duties intended. An an adjunct to the repair station the training of high caliber repairmen schooled in the art of proper maintenance and armed with the correct tools were found to be essentially necessary. Standardization of lubricating fittings and devices were included in the repairman's line of duties and as such has virtually eliminated the high inventories demanded in the past.

Due to the enormous tonnages involved in steel production it can readily be anticipated that proportionately large volumes of processing lubricants are demanded thereby. Development of the most economical type lubricant for the various individual operations involved is constantly being pursued by the lubrication engineer. The product used must, by necessity, meet all the speed ranges and quality requirements demanded by the specific type of operating conditions. Reclamation and re-use of the oil contributes heavily to operating economies.

Preparation of finished steel product for shipment to the trade includes provision of the necessary protective coatings to insure that the product arrives at the point of destination in a usable condition. The type of product employed is being dictated by the method of packaging, method of shipping employed, and type of equipment employed by the customer for removal of said coating prior to further processing or fabrication.

Rehabilitation of the large and costly bearings employed in the production of steel within our corporation has become indirectly the responsibility of our plant lubrication engineers due primarily to our method of allocating responsibilities. It is believed personally that a better evaluation of the economics involved are obtained whenever the lubrication engineer is held equally responsible for bearing costs and lubrication costs. This policy tends to make the individual bearing conscious and will further stimulate his field of endeavor.

Recently our corporation has instituted what we refer to as our central spares storage yard program. This program entails selection of a conveniently located storage space wherein all spare parts not used in routine operation are properly prepared for storage by usage of the correct type of protective coating for the storage intended. Development of the correct protective coatings is in reality the difference between success or failure of the entire program. All machined surfaces are protected prior to leaving the shop for subsequent usage in the mill or stored in the spares yard.

Training of maintenance personnel as to the best recommended lubrication practices will undoubtedly prove to be the key to preventive maintenance. Every effort must be extended to assist our maintenance forces to better understand the need for diligence on their part regarding the lubrication phase of such programs. It behooves each and every one of us to put our individual shoulder to this wheel of industrial progress.

Discussion by Victor A. Ryan

Director of Research,
Crown Cork & Seal Co., Inc.

Mr. Read has presented a very timely and commendable paper which is replete with information of tangible value to both the lubrication engineer and the "management" which employs him. Although the paper has many features, I believe that the one of greatest help to the lubrication engineer is Mr. Read's division of lubrication engineering functions into: the three broad phases of field application, the three distinct steps of purchasing, and the three separate categories of skills and experience. Nine foundation stones on which to build a successful lubrication program!

It appears that the addition of one more stone would round out the foundation and insure the success of a program. I would like to add this stone. Its significance would be, "the ability of the engineer to translate lubrication into dollars and cents and to present his accomplishments to management in the only language which management understands." The lubrication engineer must realize that you can't "sell" management unless you quote a firm price. Many years ago I realized that I wasn't getting very far with my industrial chemistry when I wrote my equation as: $NaOH+HCl=NaCl+H_2O$; but you'd be surprised to learn how far I really got with management when I changed it to: $NaOH+HCl=\$+¢$. The same applies to lubrication. Management is in business to make profits. Unless a program or proposition states the approximate amount of profits it will bring to the company's treasury, it will not receive management's favorable consideration.

Mr. Read, in his paper, mentions several examples of affected economies and expresses his savings in terms of percentages. I would like to corroborate his statements with several experiences in my own company which led to the acceptance of lubrication engineering by the management and the organization of a Lubrication Division as part of our Engineering Department. Prior to this time, lubrication problems were part of the curriculum of the Research Department and were issued to it only when operating departments were in trouble.

For example, a cork plug molding machine was using 3300 gallons of a 38¢ oil to lubricate its oven chain. The oil in use was giving considerable trouble due to its lack of proper adhesion and its low volatility which caused it to burn-off on each pass through the oven. In addition, there was considerable wear with frequent renewal of chain parts which averaged $486.60 for the year preceding our study. A special lubricant was developed which cost 57¢ per gallon but the consumption was cut to 825 gallons per year and the cost of chain parts was reduced to $15.28 per annum. The saving effected was as follows:

Old Lubricant—3300 gals. @ 38¢ gal.—	$1254.00	
Chain replacement parts	486.00	
Cost of prior lubrication		$1740.60
New Lubricant—825 gals. @ 57¢ gal.—	470.25	
Chain replacement parts	15.28	
Cost of present lubrication		485.53
Yearly Saving—		$1255.07

It is shown that the cost of lubrication was reduced 72% by increasing the cost of the lubricant 50%. This will serve to illustrate that, wherever lubricants play a part, the cost of the lubricant has very little, if any, bearing on the cost of lubrication as a whole.

Another example is that of an electrolytic tinning line on which there was excessive wear on the current-conducting shoes. The shoes were of compressed graphite and powdered copper. With the lubricant which was in use, 672 shoes which cost about $2.25 each were being completely replaced every three to four months at a minimum cost of $4500.00 per year. The builders of the machine assumed that the lubricant had to be a high grade transformer oil since shoes were conducting high current. Research ascertained that the transformer oil in use was totally devoid of lubrication properties and was functioning only as an anhydrous cooling dielectric medium. A study of the machine design indicated that a conducting, and not an electrical insulating, medium was required. Consequently, a special electrical conducting lubricant of high lubricity and low interfacial tension was developed and put into service. At the end of the first twelve months of service, there was no perceptible wear on the shoes and there was not a single case of breakage or replacement. The new lubricant was approximately the same in cost as the transformer oil. Therefore, the saving, or reduction in the cost of maintenance, on this machine was $4500.00 per year.

Many more examples could be cited if time permitted. I would, however, like to take enough time to state that Research did not offer management a definite lubrication program until it had successfully effected substantial savings and established a proposition which had a demonstrated dollar value for the treasury. In working out our proposition we selected a group of manufacturing departments using about 35,000 gallons of 126 different lubricating oils per

(*Continued on page* 148)

IMPROVED HIGH-SPEED ROLLER BEARINGS*

by Donald F. Wilcock
and
Frederick C. Jones

Thomson Laboratory
The General Electric Company
West Lynn 3, Massachusetts

Dr. D. F. Wilcock was born in Brooklyn, New York, 1913. He obtained his B.S. in C.E. from the Harvard Engineering School in 1934 and in 1939 received the degree of Doctor of Engineering Science from the University of Cincinnati, specializing in physics and physical chemistry.

He was employed in the Oil Research Laboratory of the Sherwin-Williams Company in Chicago from 1939 to 1942. He joined the G-E Research Laboratory in 1942 where he worked on the development of silicone oils. In 1945 he was transferred to the Thomson Laboratory at the General Electric Lynn River Works Plant in West Lynn, Massachusetts, where he is in charge of the Bearing and Lubricants Center.

He is very active in the scientific world and, among other duties, is a member of the Special Research Committee on Lubrication of the American Society of Mechanical Engineers.

Mr. Jones received his Bachelor of Science Degree in Chemistry from Washington College, Chestertown, Md., and his Bachelors Degree in Mechanical Engineering from The John Hopkins University. He then joined the Glenn L. Martin Company. After two years in the army he joined the General Electric Company to work in the Thomson Laboratory of the Lynn River Works.

Today's roller bearing designs are a tribute to the skill and ingenuity of the roller bearing manufacturers and engineers Great reliance has been placed upon bearing quality in the application of roller bearings to gas turbines. However, the increased demands which are placed upon gas turbine bearings by way of conditions of high speed, high load and high temperature, either singly or in combination, have resulted in operating conditions which at times may be marginal. Recent efforts to remove such marginal conditions and to replace them with the certitude of a reasonable safety factor have been facilitated by the willing co-operation of the bearing manufacturers who have prepared many sample bearings for test, on special order.

A careful and detailed examination of bearings removed from turbine engines has revealed that the principal source of difficulty lies not in the steel races, not in the steel rollers, but in the roller separator or retainer. The separator normally used in these high-speed, high-temperature bearings is made of free machining yellow brass. It is guided, or held in place, by sliding on shoulders on the inner race of the bearing. This portion of the bearing consists, therefore, of a sleeve bearing with a length extremely short compared to its diameter. Sliding between the separator and its inner race guide, and between the separator and the rollers which it spaces and by which it is driven, requires excellent lubrication at these points. This is difficult to provide during starting and stopping when the sliding velocities are low. The very low viscosity oils used in aircraft gas turbines to obtain satisfactory low-temperature starting characteristics make it more difficult to build up a separating oil film between the parts of the bearings used in such engines and, in addition, impose the hazard that the bearing adjacent to the turbine wheel may become hot enough after the engine stops to volatize most of the oil from its sufaces.

Rubbing off of brass onto the steel parts has been noted on some bearings. Bearings which have failed in special engine tests show considerable smearing of brass upon the working parts, and usually broken retainers. It is thought that brass transferred to the steel parts by rubbing may under particularly adverse conditions weld to the brass retainer and result in a momentary halting of the retainer, skidding of the rolls, and breakage of the retainer.

In order to study full size bearings under controlled conditions, a laboratory test stand has been constructed capable of simulating engine operating conditions of speed, load and temperature. With this laboratory machine, separator lubrication has been studied and the possibility of improving performance by the use of other separator materials has been demonstrated. A number of general conclusions have been reached as a result of these studies:

1. No difficulty is experienced in lubricating the roller bearings when they are running at high speed and are lubricated with a continuous jet of AN-O-9 Grade 1010 oil.
2. Numerous starts and stops under lubricated conditions result in small amounts of brass being transferred to the steel parts upon which the separator slides. When the steel parts have been oxide coated to provide protection against corrosion, brass transfer is found to be more severe.

* Paper presented at 4th Annual Convention of A.S.L.E., April 12, 1949.

3. Operation of the bearings dry results in rapid failure and destruction of the separator in a matter of minutes.
4. Separator materials other than brass have been found which greatly improve separator operation under adverse conditions. Silver plating the brass separator prolongs bearing life operating dry several fold and greatly reduces metal transfer under poor lubrication conditions. It is the best of a number of electroplates which were tested.
5. Other separator designs in which the separator is guided by the rolls rather than by the inner race may be better for operation under poor lubrication conditions, particularly when they include the use of better materials. These tests are still incomplete.

Laboratory Test Apparatus

The laboratory test apparatus being used for these tests was built to provide test conditions variable over a wide range for both roller and ball bearings. The test shaft, which may be driven by a high-frequency motor at speeds up to 14,000 rpm, is carried on two 110 mm light series ball bearings; and at its center carries two 95 mm light series roller bearings. Both the shaft and the bearing housings may be heated electrically to 200°C. Radial load is applied to the roller bearings and combined radial and thrust load is applied to the ball bearings by means of hydraulic cylinders. Lubricant is supplied through jets to each bearing at individually controlled rates up to a maximum of one gpm. Bearing temperatures are indicated by recording controllers using thermocouples contacting the bearing outer races under spring pressure.

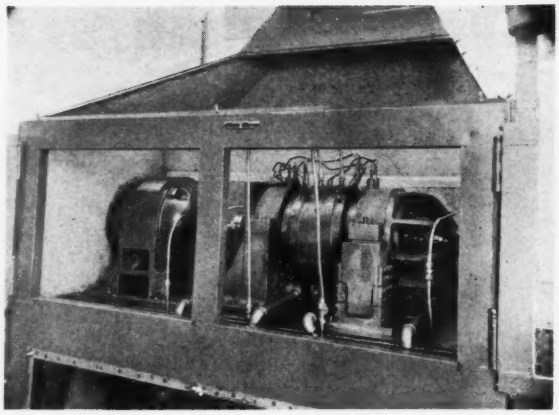

Fig. 2—Assembled Test Apparatus.

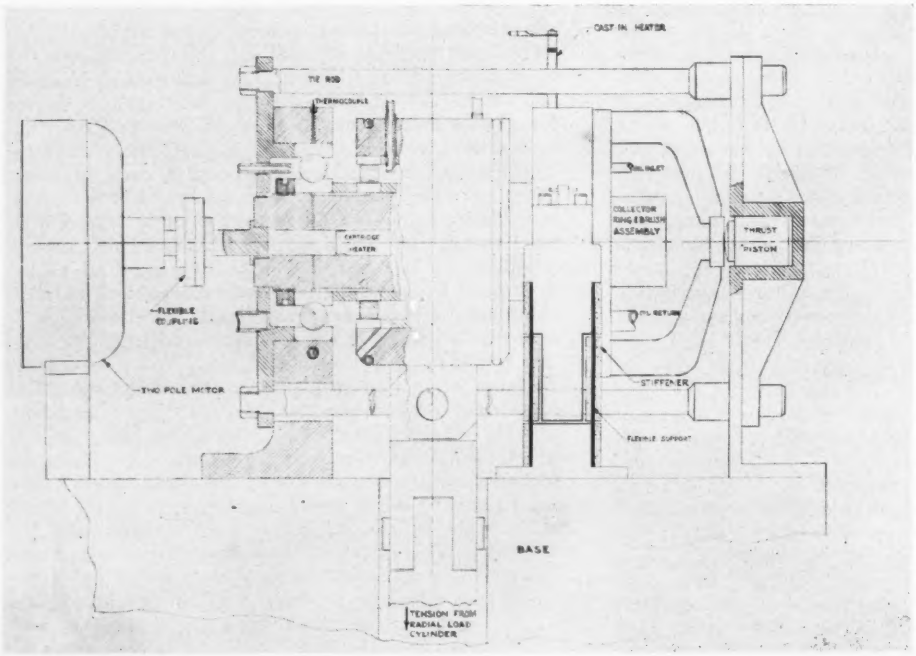

Fig. 1—Diagrammatic Section Through High-Speed Ball and Roller Bearing Test Stand.

A diagrammatic section of the test stand is shown in Figure 1. Both radial and thrust loads may be applied to the ball bearings without frictional errors in either load. This is made possible by the flexible reed support of the ball bearing housing opposite the coupling which permits this housing to move axially under the thrust load until the load is carried by the bearings. A correction for the force necessary to move the flexible support is readily made. The motor is a two-pole induction motor capable of delivering 38 hp. at 14,000 rpm. Power is supplied by a 33 kw belt-driven frequency changer, and the desired motor speed is obtained by adjusting the belt ratio. Figure 2 shows the assembled test apparatus, and Figure 3 shows a partial disassembly.

Test Procedures

A significant part of this investigation lies in the study of transfer of metal from the separator to the inner race, rolls, and outer race of the bearing. With a brass separator and bright steel parts, brass which has been transferred to the steel is readily detected because of the color contrast. However, silver and tin alloys are not readily detectable visually on steel except when present in large quantities; and, when a varnish

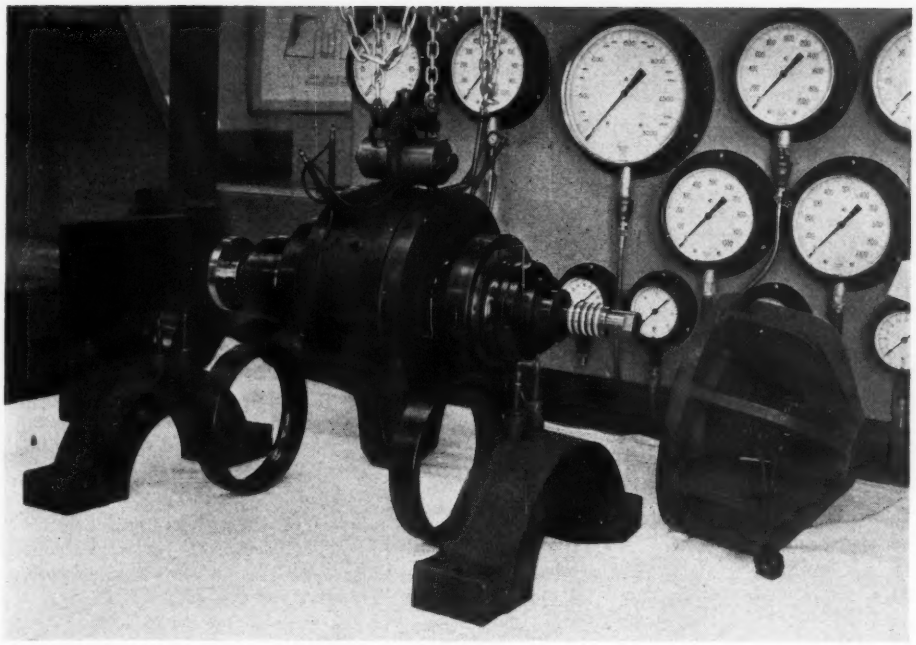

Fig. 3—Partial Disassembly of High-Speed Ball and Roller Bearing Test Apparatus.

film has formed on the steel parts, it is difficult to detect small amounts of brass. Therefore, where there was any doubt as to the presence of transferred separator material on steel parts, they were treated by immersing them in an H_2S atmosphere for several minutes. This treatment formed sulfides which were dark enough to be readily distinguished from the steel surface.

The test conditions used in studying these 95 mm light series roller bearings were as follows:

Speed	7550 RPM
Radial Load	500 Lbs.
Thrust Load	None
Acceleration	Full Speed in 8 Sec.
Lubricant	AN-O-9 Oil, Grade 1010

Under these conditions, the lubrication of the roller bearings was studied, using a number of controlled test procedures. Some of these procedures were designed to simulate possible gas turbine operating conditions; others were designed to be much more severe than any conceivable operating conditions in order to cause rapid bearing failure. The several procedures used are described in detail below.

A. Steady Lubricated Run. Operation is continued for 24 hours with Grade 1010 oil furnished to each bearing at the rate of 0.5 gpm. Bearing temperatures are maintained at 120°C (248°F).

B. *Multiple Starts.* Oil is fed continuously to each bearing at the rate of 0.5 gpm, and bearing temperatures maintained at 120°C (248°F). Seventy-five starts are made, with an operating period of two minutes and and off period of five minutes.

C. Delayed Lubrication Starts. After operating the bearings for five minutes with normal lubrication, they are stopped and heated to 187°C (369°F). After two hours at this temperature the roller bearings are started dry and ten seconds later oil is admitted. After five minutes running, this procedure is repeated until five starts have been made.

D. *Baked Oil Operation to Failure.* The roller bearings are installed in the test stand clean and dry and are heated to 130°C. Oil is turned on, and they are operated at this temperature with oil feed for five minutes. They are stopped, heated at 218°C (425°F), and maintained at this temperature for two hours. During this period most of the oil vaporizes from the bearings, the residue being a slight varnish-like coating. After cooling to 187°C, the roller bearings are operated without lubrication until failure of one bearing stalls the test machine. Before starting, the ball bearings supporting the test shaft are lubricated with a heavy oil by means of an oil can. If the roller bearings operate under these dry conditions for any prolonged period, the stand is stopped every ten to fifteen minutes, long enough to permit re-oiling of the ball bearings. Oil spray or vapor from the ball bearings is prevented from entering the roller bearing housing by means of shields.

E. *Dry Operation to Failure. Method 1:* New bearings, without previous operation, are carefully cleaned in a volatile hydrocarbon solvent, dried, and installed in the test stand. With no lubrication of the roller bearings, the stand is started and run until one of the roller bearings fails. *Method 2:* New bearings are operated with oil lubrication for five minutes. They are then removed from the test stand, cleaned in a volatile hydrocarbon solvent, dried, and replaced in the test stand. The stand is started without lubrication of the roller bearings and run until one of them fails. Operation for longer than ten minutes requires periodic stops to oil the ball bearings as described in D.

Test Results

Using Procedure E (Dry Operation to Failure), the life of these roller bearings was found to be very short, from a few seconds to a few minutes. Some of the results obtained are shown in Table I in which the performance of bearings with brass separators is compared with the performance of bearings with silver-plated separators. Figure 4 shows the appearance of a brass separator bearing after failure and before removal from the bearing housing. The broken separator is clearly visible. The same bearing is shown in Figure 5 after removal from the test machine.

TABLE I

Comparison of Running Time to Failure of 95 mm Roller Bearings with Brass and Silver-Plated Separators, by Procedure E (Dry Operation to Failure).

Time to Failure, Minutes			
Proc. E1—New Bearings		Proc. E2—Run-In Bearings	
Brass Separator	Silver Plated Separator	Brass Separator	Silver-Plated Separator
0.85	0.23	4.00	4.93
1.08		2.77	7.85
0.25		1.02	5.73
0.30		4.33	
0.62 Min. Avg.		3.03 Min. Avg.	6.17 Min. Avg.

Fig. 4—Brass Separator Bearing After Failure and Before Removal from Housing.

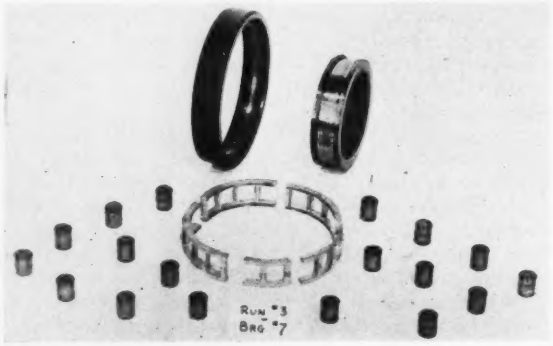

Fig. 5—Brass Separator Bearing Shown in Fig. 4 After removal from the Test Machine.

When new bearings are tested without previous operation, the life when run dry and without lubrication averages only 0.6 minutes. Silver plating the separator appears to afford no improvement under these conditions. When the bearings have been run-in with oil lubrication for five minutes before being tested dry, their life is considerably greater; and bearings with brass separators average three minutes running before failure while bearings with silver-plated separators show improved performance and operate an average of six minutes before failure. The improvement caused by running-in the bearings in the presence of oil is probably due to the removal of high spots on the sliding surfaces

TABLE II

Comparison of Running Time to Failure of 95 mm Roller Bearings with Brass and Silver-Plated Separators, by Procedure D (Baked Oil Operation to Failure).

Time to Failure, Minutes	
Brass Separator	Silver-Plated Separator
4.17	409.
6.81	72.
0.32	395.
3.77 Min. Avg.	292. Min. Avg.

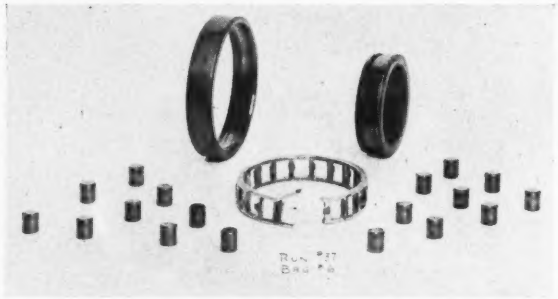

Fig. 6—Appearance of Roller Bearing with Silver-Plated Separator. Failed After Running 6 Hours 49 Minutes Dry.

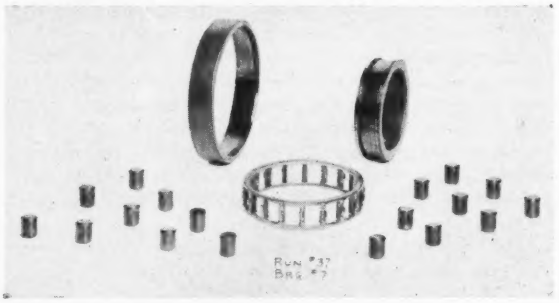

Fig. 7—Appearance of Roller Bearing with Silver-Plated Separator. Paired with Bearing Shown in Fig. 6. This Bearing Did Not Fail.

under conditions which will not cause gross seizure, thus permitting longer operation dry.

A more practical test is that of Procedure D (Baked Oil Operation to Failure), in which instead of removing the lubricant by solvent cleaning it is removed by heating the bearings until almost all the oil vaporizes and only a slight varnish-like film is left behind on the bearing parts. Under these conditions the results shown in Table II were obtained. Bearings with brass separators average 3.8 minutes before failure as compared with 3.0 minutes when they are solvent cleaned. However, bearings with silver-plated separators operate an average of 292 minutes before failure. Figure 6 shows the appearance of the bearing with a silver-plated separator which failed after six hours and 49 minutes. The other bearing which had not failed at this time is shown in Figure 7. One is well nigh forced to the conclusion that the burned remains of the lubricant film have some residual lubricating ability; and with this minimum of lubrication the silver-surfaced separator performs some 77 times as well as the brass surface.

These repetitive tests on brass versus silver-plated separators were made on these materials because brass is the material in normal use and because silver plate was found to be superior to a number of other electroplated surfaces which were tested. Some promising tests are under way on separators made of base materials other than brass which, unfortunately, are incomplete

TABLE III

BEHAVIOR OF VARIOUS SEPARATOR MATERIALS UNDER THE DIFFERENT TEST PROCEDURES.

SEPARATOR MATERIAL	PROCEDURE A STEADY LUBR. RUN No Metal Transfer	PROCEDURE B MULTIPLE STARTS	PROCEDURE C 5 DELAYED LUBR STARTS	PROCEDURE D BAKED OIL OPERATION TO FAILURE	PROCEDURE E2 DRY OPERATION TO FAILURE
Leaded Yellow Brass	No Metal Transfer	Very Slight Transfer	Noticeable Transfer	3.77 Min. Avg.	3.03 Min. Avg.
Chromium Plate	————	No Transfer Wears inner race	No Transfer Serious wear on inner race	————	————
Silver Plate	No Metal Transfer	No Metal Transfer	Trace of silver on inner race	292. Min. Avg. Plate worn off in small areas	6.17 Min. Avg.
Silver-Lead-Indium Plate	No Metal Transfer	No Metal Transfer Some wear in pockets	Slight metal Transfer	115 Min. Plate worn off in spots	————
85-12-3 Lead-Tin-Copper Plate	No Metal Transfer	Very Slight Transfer Contact areas polished	No Metal Transfer	81 Min. Much plating worn off in pockets and on lands	————
97-3 Tin-Copper Plate	No Metal Transfer	Slight Metal Transfer Contact Areas large but polished	Slight Metal Transfer	9.4 Min. Heavy metal transfer to races and rolls	————

and cannot be reported at this time. A number of electroplated compositions have been compared using several of the testing procedures, and Table III summarizes the results which have been obtained. The plates compared are chromium plate, silver plate, silver-lead-indium plate, lead-tin-copper plate, and tin-copper plate. All platings were an estimated 0.001 inch thick.

The chromium plate was found to be too hard, with the result that it wore the steel surfaces with which it came in contact. At the same time, some spalling of the chromium plate occurred. The silver-lead-indium plate formed numerous tiny bubbles on the surface after the high-temperature runs. The brass base material was found to be still tinned beneath these bubbles. The lead-tin-copper plate and the tin-copper plate also tended to form bubbles on the surface beneath which the brass was still tinned. In addition, large portions of the surface showed evidence of mobility during the high-temperature runs and some evidence of throwing plated material off the separator against the outer race during testing under Procedure D. The tin-copper plate appeared to be considerably inferior to the others although somewhat better than brass.

With no one of the separator materials tested was any difficulty experienced in continuous operation under lubricated conditions (Procedure A). In view of the low viscosity of the oil (10 centistokes at 100°F) this is very satisfactory behavior. The slight amounts of metal transfer found during the multiple starting tests (Procedure B), except in the case of the chromium and silver plate, indicate as might be expected that lubrication is more difficult during the acceleration and deceleration periods and that the hydrodynamic forces tending to build a separating oil film are small.

Discussion

Perhaps the most interesting aspect of these tests, even more than the discovery of better separator surface materials, is the remarkable ability of these precision roller bearings to operate under adverse conditions. In one test a pair of these bearings were operated for over thirty minutes with only the oil remaining on them from a previous run as the lubricant. When a silver-surfaced separator is used, we have the remarkable circumstance of bearings capable of operating several hours without lubrication before failure occurs. Why the silver surface is so superior is a question for much speculation. It is known that molten silver will not wet steel, and this fact may be a factor in minimizing to a large degree the transfer of silver to the mating steel surfaces. If transfer and welding cannot take place, seizure of the bearing parts and hence of the bearing becomes very unlikely. Another factor which doubtless is important is the hardness of the separator surface. The very hard chromium surface did not transfer to the steel, but it was so hard that it wore the steel surface rapidly. The presence of softer, lower melting, weldable lead and tin in the other plates tested probably accounts for their relatively much poorer performance.

* * *

Written discussion of this paper, together with the authors' reply, will be published in the August issue.

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PREVENTING ACCIDENTS BY PROPER LUBRICATION*

by Walter E. Montgomery

Walter E. Montgomery was born in Pittsburgh, Pennsylvania, April 6, 1904, but has lived in Canada for the past 20 years.

He is at present Safety Director of Kenneth B. Robertson, Limited, of Montreal, Canada. This company specializes in Workmen's Compensation Reinsurance of large industrial companies including many in the United States. He is in charge of safety inspection work. He makes periodic tours of many different kinds of companies and thus has first hand knowledge of the subject he discusses.

He is a member of the following organizations: American Society of Safety Engineers, Veterans of Safety, Canadian Standards Association, also Vice-Chairman of Committee Z94—Code for Head and Eye Protection, National Fire Protection Association, American Standards Association, Canadian Institute Mining and Metallurgy, First Vice-Chairman—Executive Committee—Mining Section Nation Safety Council.

Every accident has two parts: (A) a cause and (B) a result. The cause usually occurs either when someone does something he should not have done such as a mistake or an unsafe method, or when someone fails to do something he should have done, for example, failure to act or to use safe methods or proper equipment specifically intended for the particular job. The result of an unsafe act or omission may be (A) personal injury or death to one or more persons; (B) damage to equipment, machinery, material or other property; (C) injury or damage or (D) an interruption or hold-up work without damage or injury.

An accident is also classified as an unexpected occurrence which may or may not result in an injury.

I have no doubt that many of you are wondering just what is the relation between "accidents" and "lubrication" and I trust that I may be able to tie the two together in such a way that will be interesting as well as useful to you, and at the same time, serve as an ultimate purpose; that of preventing accidents. This has been done by a study of past conditions where lubrication was a factor to some degree in accidents where loss of property or life was involved.

Occupational accidents in 1947 cost American Industry over $2,600,000,000. The property loss resulting from fires in 1947 totalled approximately $648,000,000, which is the largest total on record. Fires in dwelling occupancies were 52 per cent of the total, but the loss was only 26 per cent of the total. The balance being charged to mercantile and industrial establishments.

The Handbook of Fire Protection reveals that 10 fires were caused in the leather working plants by overheating of bearings. The Pulp & Paper industry records 171 fires caused by overheated bearings. Plastic processing plants also charge 10 fires to the same cause. Textile plants list 287 fires which were attributed to overheated bearings in processing equipment

Factory Mutual Records indicate that out of thirteen various causes of fires in cotton occupancies, friction is listed as the second highest, being responsible for 1410 fires. This is further subdivided showing that hot bearings alone accounted for 496 fires or 35 percent of this total.

Friction causes many more fires in cotton mills than is generally appreciated. In opener and picker rooms, friction causes 11% of the fires, in spinning rooms, 31%; in card rooms, 45%, and in weave rooms, 61%. To the thoughtful mill executive, this suggests that lubrication needs more attention than it is getting. Proper lubrication not only eliminates an important fire cause which threatens to interrupt production, but it also improves production and product quality. It has been estimated that 90% of the power consumed in the textile industry is used to overcome machine friction, only 10% for actual productive work. Clearly, the reduction of friction is a profitable field.

Selection of the lubricating oils and greases is strictly an engineering procedure requiring technical knowledge. Textile machinery manufacturers usually recommend suitable lubricants for the equipment they supply. However, it is beyond the scope of their responsibility to designate all qualified lubricants or to cover local conditions requiring special study by a lubrication engineer.

Every mill could well select some man from its engineering or mechanical staff to be responsible for the complete lubrication program of the mill. Such a man could soon obtain sufficient information and experience in this somewhat technical subject to well repay the time spent. The mill would benefit from a reduction in fires, from better machine operation, lowered maintenance costs, lessened power consumption, and improved quality of product.

If bearings become worn and leak oil, it may be a natural tendency to use heavier lubricants, but this never corrects the fault. It may reduce leakage, but it also increases power consumption and creates higher running temperatures. You can't repair a worn bearing with heavier oil.

The first, and probably most important fire cause, is, improper lubrication and machine maintenance. Lubrication problems in the cotton mills are as complex as those of any industry, perhaps more so. Large numbers of bearings, high speeds, vibration, contamination of bearings by ever-present lint and dirt, all tend to complicate matters. Yet, very little has been done to simplify lubricants, or lubrication methods. Many other industries have long since put their houses in order.

* Paper presented at 4th Annual Convention of A.S.L.E., New York City, April 13, 1949.

To accomplish parallel improvements in the textile industry, requires the combined cooperation of textile machinery builders, lubricant manufacturers and most important, the mills themselves. Standardization of bearings and lubricants is the aim of the American Society of Mechanical Engineers and the American Standard Association.

A recent survey of 250 cotton mills, mostly southern, disclosed that over 40% had never availed themselves of the servces of a lubrication engineer. These mills reported 15% more fires. Most oil companies are glad to advise a mill regarding proper types of oils and methods of storage and application.

Such expert aid would result in:—

1. Saving of power.
2. Lower maintenance costs.
3. Improvement in conditions which affect the fire loss record.
5. Improvement in production schedules and quality standards.
6. Better personal safety conditions.

One large New England mill, after tackling this problem in earnest, reported an annual gross saving of over $14,000. As a contrast, a nearby mill, also a large one, using the same oils and greases, admitted wasting over half of the lubricants and seemed disinterested when lubrication was mentioned.

A plant which is careless of lubrication soon finds out it is rated a poor risk by its fire insurance company.

The Factory Mutuals have taken an active interest both direct, as well as through other agencies, such as engineering societies, textile machine manufacturers, and leading lubricant producers to improve conditions in textile mills. There has been definite progress made, although no co-ordinated program has been developed thus far.

Cutting Oils

The proper sanitary handling of cutting oils, with a view to preventing lost man hours, is an important phase of the Safety Engineer's work. Cutting oils are the most frequent carriers of dermatitis among machine and metal workers. Precautions can be taken to reduce this to a minimum. They include the use of special disinfectants and germicides in the oils, protective ointments, industrial skin cleaners and protective clothing.

Thousands of different formulations come under the heading of "Cutting oils," but they can all be divided into two large groups—soluble and insoluble. This simple classification makes it comparatively easy to clearly understand the health hazards involved and the preventive measures necessary for each group.

Soluble Cutting Oils

The principle function of soluble oils is to cool the cutting tool so that it does not lose its temper and break or chip. Their secondary function is lubrication. Soluble oils are diluted with many times as much water and allowed to flow over the cutting operations. Other shop names given cutting or grinding solutions in this category are: coolants, cooling compounds, pigeon's milk, "water." They consist of sulfonated mineral and fatty oils, 60 to 95 percent; soaps 5 to 30 percent, and volatile contents, 0 to 10 percent.

Insoluble Cutting Oils

These are used mainly as lubricants, aiding the tools in the cutting operation. The insoluble type of cutting oil consists principally of 55 to 100 percent chlorine in the form of chlorinated hydrocarbons. The fatty oil content may be oleic acid, lard oil, fish oils or vegetable oils.

Action on the Skin

Insoluble or straight lubricating oils used as cutting oils are frequently the cause of dermatitis—much more frequently than the soluble oils or coolants. There are several reasons for this. There is more actual exposure to the oil, because in the coolant form there is only a small percentage of actual oil. The petroleum oils have the property of defatting the skin. All oils may plug the pores of the skin and form oil pimples. Secondary infection may cause folliculitis and boils. Usually, such a dermatitis is a two-stage affair. First, the skin becomes irritated from chemicals in the oil, then bacteria are carried by dirt and grease into the opening about the hairs and the way is open for infection. Itching inevitably follows, and causes scratching with bacteria-laden finger nails, or rubbing with dirty hands, arms or clothing. As a result, the skin is broken and germs find an open door to a fine incubator.

After use, cutting oils contain many metal particles which may wound the skin. Skin wounds may also occur from old waste impregnated with slivers of metal if such waste is used for wiping oil from the hands. The result is often a series of inflamed oil pimples—or folliculitis. The vast majority of dermatosis from cutting oils fall in this class.

Many heavy duty cutting oils containing sulfur and chlorine are highly irritating and may cause an outbreak of straw colored cysts of the sweat glands known as chlorance. Long time exposure to cutting oil frequently results in development of small flat brown masses on the skin called papillomas.

Prevention of Dermatitis

The basic principle is separation of the irritant from the worker. This may be done by mechanical means such as the use of hoods, suction apparatus, and other devices to prevent irritating substances from reaching the worker or by personal protection as protective clothing and protective ointments.

Hazard to Oiler

Safety Engineers have realized for years that the most hazardous of all jobs is that of the oiler. He is the lone wolf of industry. The very nature of his job takes him to remote places seldom frequented by anyone else, it exposes him to severe hazards of moving machinery, it involves climbing and gymnastics that can only be duplicated by a monkey, and even he needs a tail. Oilers have caused more gray hair among safety men than any other class of workers. If any of you are doubtful, I would suggest you follow an oiler for just one shift.

Due to the frequency and severity of accidents among oilers studies have been made to reduce his exposure to hazards which have since become unnecessary. Bearings have always seemed inaccessible and ladder climing is more the rule than the exception. When you realize that many bearings require attention at least once a shift, it means that the oiler has to climb up a ladder, give the grease cups a couple of turns, and then climb down with slippery hands. The fact that he is not involved in more accidents is amazing.

Years ago we were well aware of this problem and tests were made to see how far the old-style grease cup could push cup grease through a quarter and three-eighth inch pipe in an effort to keep the oiler on the floor, but cold weather was a restraining as well as a halting influence to these tests and we were forced to

give them up. Some of the temperatures involved went as far as 30 below zero and 3 feet was our limit of grease cup extension.

Now that water-free greases and pressure fittings are available we have made pipe installations to remote bearings in excess of 30 feet with sub-zero weather no longer being considered a serious factor. In fact, bearings are now being lubricated where in the past they were conveniently forgotten and our maintenance records bear this out. Where extremely cold weather is encountered a 50% increase in pipe size is recommended.

Every bearing grease pipe extension saves the oiler 300 round trips a year and if this remote control accident free system is installed on only 100 bearings you have saved the worker 30,000 ladder trips annually, with added assurance that the bearings are receiving their required attention. Start multiplying that for a large industry and you don't have to be an industrial engineer to realize the monetary saving in such a system. It has reduced the oiler accident exposure to a mimimum.

Centralized Lubricating Systems

In recent years various systems of central lubrication have made great strides and there is much to be said of the many benefits to be derived from these systems. One of the most important is the absolute safety of application that permits bearings and machinery to be lubricated while it is in motion, by completely eliminating the human element and its accompanying hazard, not to mention downtime for lubrication.

The widespread use of central lubrication systems has been an important factor in reducing accidental injuries to oilers by keeping them on the floor and out of hazardous places while at the same time equipment is being properly maintained.

While safety is being increased, costs are being lowered for it has been estimated that the saving in grease alone will average 50% to 70% in the amount, and cost, of lubricant required.

Accident Investigations

In investigating accidents many seemingly unrelated factors are discovered. Workmen become involved in gears, belts, and pulleys and are injured. The uninformed or uninterested blandly state "he shouldn't have done it,—he shouldn't have been there,—he must have done something wrong" and ad infinitum. An investigation occurred years ago which determined that more belt and pulley accidents were occurring on Winter Monday mornings than any other day and were traced to the manner, in which the mill was being started.

After the weekend shut-down, with the mill idle from Saturday night to Monday morning, with sub-zero temperatures being an important factor, it was necessary to start almost every piece of equipment by hand, and only one at a time. I should add the bronze sleeve bearings were more the rule than the exception. You can well realize the starting torque required of numerous bearings that were bound by frozen cup grease.

This necessitated pulling on belts by hand, turning sprockets, chains, and gears with bars and wrenches. All this mind you, with the power on. Is there any wonder we found a predominance of "belt" accidents on Monday morning.

In the old days it took a whole gang of 35 men several hours to start the mill after a 24-hour winter shut-down. Now it takes six men one hour to have the mill in full running order with all equipment loaded at 20 below zero.

In the old days 10 H.P. did the work of 5 H.P. and a 2½" shaft was required instead of 1½". It took 100% more starting load in the winter time, now it takes 20% more. It was previously stated that in the Textile Industry only 10% of the power was used in productive work and 90% to overcome friction, but here is an instance where it takes 200% power to start an *empty* mill when it is cold. Now it is no longer necessary to change from "summer" to "winter" motors. A mill loaded with 100 tons of ore throughout the flow can now be started in 11 minutes in the summer time. All this has come to pass by the elimination of high friction sleeve type bearings in favor of anti-friction bearings and the adoption of modern engineered greases and oils instead of the universal use of the yellow cup grease. Likewise, we have no more Monday morning belt accidents.

Hoisting Ropes

Hoisting accidents are not as numerous as those from other causes, such as falls of various kinds, but in non-coal mines this type of accidents takes a greater toll of lives than any cause other than falls; and in some years shaft fatalities are about on a par with those from explosives and underground haulage. In coal mines, shaft accidents ordinarily do not constitute as serious a problem as do those from falls, underground haulage, explosives, and electricity.

Safety in hoisting is a problem of considerable complexity with many ramifications that may cause dangerous conditions to exist. Only by understanding the common causes of wire rope failure and knowing what is generally accepted as good practice in mine hoisting can shaft accidents be reduced.

The recommendations of the American Standards Association relative to wire-rope lubrication follow:

Section 611: Lubrication.

Rule 6110: It is advisable that the lubricant recommended by the rope manufacturer be used.

Rule 6111: Wire-rope lubricant should be commercially chemically neutral.

Rule 6112: It should not harden sufficiently to crack, chip or peel, nor soften sufficiently to drip off the rope under extreme atmospheric conditions.

Rule 6113: It should not dry out rapidly in service.

Rule 6114: It should be practically free from moisture, not absorb moisture readily and be impervious to surface moisture.

Rule 6115: It should be of such a nature that it can penetrate between the strands to the core of the rope, and should be applied in such a manner as to secure maximum penetration.

Rule 6116: It should possess such adhesive qualities as not to be thrown from the rope by vibration nor rapid motion.

Rule 6117: Its physical and chemical qualities should permit heating to a liquid consistency for ease of application.

Rule 6118: Lubricant should be applied at frequent intervals to protect the wires of the rope from friction and corrosion.

Application of lubricant—Correct lubrication not only lubricates the wires of the rope but provides protection to the rope. To be effective, lubrication should be carried out in two steps.

Step 1 — The application of a relatively light penetrating oil which will adhere to the individual wires and penetrate to the core, or hemp center.

Step 2 — The application of a shield or protector, to resist the washing action of rain or mine water.

The hoisting rope should be cleaned, and accumulated dirt and gummed lubricant should be removed from the valleys between strands. The use of compressed air, superhead steam, or a combination of both is essential to loosen and remove the foreign material as well as to dry the rope and prepare it to receive fresh lubricant and protector. Steam without superheating should not be used because it leaves moisture on the rope.

Safety and deterioration of hoisting ropes are so closely associated that it is difficult to discuss them separately. The short life of ropes compared to that of most mining machinery increases the necessity for understanding the nature of the deterioration and determining the factors adversely affecting the length of service, particularly as human life may be the price of a mistake in judgment regarding the remaining strength of a rope.

Hoisting ropes used in mines are subject to three kinds of deterioration—abrasion, corrosion, and fatigue. Ropes in active service soon show abrasion of the outer wires owing to friction on rope drum and sheave. Internal wires, by rubbing against each other, also, suffer abrasion. Every time a wire is bent by running over a drum or sheave, bending stresses are induced; every time a rope is loaded, tension stresses are caused in the wires; and every time the load is varied, bending stresses are created. These stresses eventually cause fatigue of the steel, and if they continue long enough the wires will break. Sudden kinetic loads cause severe stresses in the wires. At one installation the king bolt on the skip was equipped with a nest of coil springs to reduce the initial shock to the rope when hoisting was started. When water or corrosive atmospheres come in contact with the steel wires corrosion takes place. In some mines acid water aggravates corrosion.

The lubrication of hoisting ropes has been given much attention by ropes manufacturers. The rope manufacturers' first consideration is the proper lubrication of the hemp core. American wire-rope manufacturers select hemp for cores from supplies known to be free from acid or salt. Several rope manufacturers have co-operated with the cordage manufacturers to the end that proper and ample lubricant shall be added to the hemp core during its manufacture. Some rope manufacturers increase the amount of lubricant in the hemp core by passing it through a hot lubricant. Where still more lubricant is desirable the hemp rope is coiled and left in a tank of heated lubricant for several hours.

The next consideration in wire-rope lubrication is to see that every wire in the rope is covered thoroughly with a protecting film of lubricant. *A* rope with perfectly lubricated wires has a higher breaking strength than one with poorly lubricated wires. Different methods are used to coat each wire with a lubricant during the stranding process. In addition, some manufacturers introduce lubricant in the strands by pressure methods. Thus hoisting ropes, especially of recent manufacture, are thoroughly lubricated when they leave the factory.

It is more difficult to lubricate the rope properly throughout its life. A rope should be considered as a machine with many wearing surfaces that need constant lubrication. The lubricant should penetrate the spaces between the wires and strands and should not harden. A lubricant that hardens, cracks when the rope is bent and forms crevices where moisture accumulates, which may permit internal corrosion. Tar should never be used. If possible the rope should be lubricated when dry. The lubricant should be applied often enough to keep the wires well covered and to prevent the hemp core from drying out.

A point worthy of emphasis is the importance of adequate rope lubrication from the standpoint of safety. Lack of lubrication may result in early destruction of the hemp core and premature deterioration of the rope. Proper lubrication is essential to the prevention of both internal and external corrosion. On the other hand, the amount of wear and the number of broken wires, considered in connection with previous service records, give a good indication of the condition of the rope, except for corrosion.

From the foregoing, the importance of preventing corrosion by keeping moisture out of the cable through proper lubrication is evident.

Light lubricants generally can be applied without heating. Heavy lubricants to be effective usually must be heated before they are applied. Several lubricant and rope manufacturers have issued pamphlets that give suggestions for applying lubricants. These may be obtained by writing to the manufacturers.

The object of field lubrication should be to keep the core and strands well lubricated throughout the life of the rope and to keep out moisture. To accomplish this the lubricant must actually penetrate to the core and adhere to the rope at its maximum speed. Some companies first apply a light lubricant intended to lubricate the interior of the rope, then a heated, heavier lubricant to seal the crevices and keep moisture from entering the interior of the rope.

While much progress has been made in recent years in selecting the proper lubricant for a given condition, it is believed that further study and research will result in better rope service. Rope users who have not given this problem their serious attention should do so for both safety and economy.

Wire rope is not simply several pieces of wire; it is a complete machine. A 6 x 19 rope, for instance, is made up of 114 wires plus a core. As the rope bends over sheaves and drums the wires continually move and rub against each other. Each wire becomes a bearing surface that grinds and wears against other wires — unless all are properly lubricated.

Proper lubrication is just as important to wires in your rope as it is to gears in your machine.

Wire Rope Corrosion

Corrosion starts as soon as wires and strands are exposed to the elements and usually starts before one is aware of it.

In its early stages, corrosion is difficult to detect. The first signs are a general discoloration of the wires of the rope. As corrosion progresses, the wires will become either pitted or covered with a reddish brown substance depending upon whether the corrosion is of an acid or alkaline type.

No way has yet been found to remove the 'causes' of corrosion. However, there is a method of protecting wire rope against corrosive elements, against atmosphere, weathering, or special conditions which subject the rope to either acid or alkaline substances. *That method is thorough lubrication.*

Elaborate charts are available to show when to discard ropes. These charts not only consider the number

of broken wires per lay and the position of the breaks with reference to the different strands but also allow for the amount of abrasion of the wires and combination of the two effects.

When corrosion is present, however, the remaining strength cannot be calculated with safety, nor is there any reasonable way to judge whether or not the rope is safe for further service, except by the judgment of the inspector who compares it with the condition of other ropes on the same installation, but even this is a doubtful method.

Where corrosion is present all the known methods for estimating the remaining strength of a wire rope become useless. Therefore, in setting up any definite regulations for the removal of rope it is necessary that corrosion be controlled. Corrosion should be controlled, not only because of the additional rope service that will thereby be obtained, but because it is a definite assurance of safety, and makes it possible to judge a rope in use by inspection of its exterior. Corrosion can be controlled by proper and sufficient lubrication.

Paymaster Mine Accident

The hoisting rope, on a double-deck cage, lowering 16 men at the No. 5 shaft of the Paymaster Consolidated Mines, broke at 7:55 A.M. February 2, 1945. The cage dropped a distance of 1,700 feet to the bottom of the shaft. All 16 men died.

The immediate cause of this accident was the failure of the hoisting rope. The cause of the failure was the reduction in strength of the rope caused by internal wear and corrosion of the wires. The circumstances which resulted in this condition of the rope are obscure.

At the inquest, the coroners' jury when returning their verdict, stated, among other recommendations, that "from the evidence submitted the rope broke because of internal corrosion of which there was no indication from external examination," "that a study be made on the prevention of internal deterioration of hoisting ropes by a Commission appointed by the Provincial Government, and every effort made to prevent it."

This accident set off a series of rope inspections that involved every mine in Ontario and practically every other mine in North America where ropes are used.

The Ontario Government has recorded 53 hoisting accidents involving failure of the rope, attachment or hoist in Ontario Mines. Of these 53 rope failures, 37 are classified as mechanical or operational failures while of the remaining 16, 10 failed due to severe internal corrosion and 6 due to external wear. Thus, 30% of all these rope failures could have been prevented or lessened by proper rope lubrication.

During the Royal Commission, Investigation of the Paymaster accident, a survey was made of 44 hoisting ropes under the heading of "Special Test Ropes — Basis on which ropes should have been discarded." Condition of Rope and Core at weak point in rope showed 37 of the ropes had a 'Dry Core,' 5 were classified as 'Core fair' while only 2 contained a well lubricated core. Of these 44 ropes that were condemned, corrosion was a factor in 41 of them; 8 were classified as 'Badly corroded', 18 'Severely corroded,' 10 'Some corrosion,' 5 'Slight corrosion,' while 3 ropes showed 'NO corrosion.' It should also be pointed out that 2 of these 3 ropes were listed as having a well lubricated core.

This indicates that hoisting ropes are not receiving the attention that is properly due a valuable piece of equipment.

It is important to realize that the steel of wire ropes will corrode in pure water when oxygen is present and that deterioration by corrosion is by no means limited to operations in the presence of acid-bearing waters or to salts in solution.

It may generally be said that in the case of ropes that have failed in service in Canada or elsewhere, or that on removal have shown marked signs of deterioration, by far the most frequent of the obvious defects has been a marked internal corrosion augmented, perhaps, by internal wear. Corrosion takes precedence over all other causes of failure because it has defied effective detection by present methods.

Microscopic examination of cross sections of corroded ropes has shown that the initial corrosion is chiefly found on the inside surfaces of the outer wires when they make contact with the next layer.

Strangely enough, little corrosion has been found next to the fibre core and so core or lubricant decomposition products appear to have little influence in the rope breakdown. The water that causes the principal damage, penetrates but a short distance into the interior of the rope. This suggests that the prime function of an internal lubricant is to seal the rope against the entry of water.

In a hoisting rope it is a matter of slow movement of ill fitting parts rubbing against each other. Once corrosion has started, however, and the smooth contours of the wire destroyed by the etching and corrosion products, the relative motion of the wires will accelerate their own destruction. Friction is increased by the rough surfaces and wear and corrosion proceed hand in hand.

Constant effort should be exerted to prevent corrosion and to detect it when it has taken place. So far, the only practical means of retarding corrosion appears to be the addition of 'dressing' to the rope.

In conclusion, I might observe that the membership of the American Society of Lubrication Engineers are doing an excellent job in developing new techniques and improving old ones, so that industry may benefit by the best systems available. But in view of a few of the examples in this paper there is an indication that considerable loss of life and limb and added expense are daily charged to industry by the mal-application or even non-application of petroleum products. The finest product in the world will not perform its intended duty if it is used improperly. Therefore, it is essential that additional stress be paid to the proper application of lubricants in industry in order that they are used to the best advantage for all concerned, so that effeciency is thereby increased and accidental injuries are lessened.

We, in the safety profession, have a similar ultimate object that was so aptly stated by P. B. Juhnke when he said: "And the end is that the workman shall live to enjoy the fruits of his labour; that his mother shall have the comforts of his arm in her age; that is wife shall not untimely be a widow; that his children shall have a father; and that cripples and helpless wrecks who were once strong men shall no longer be a by-product of industry."

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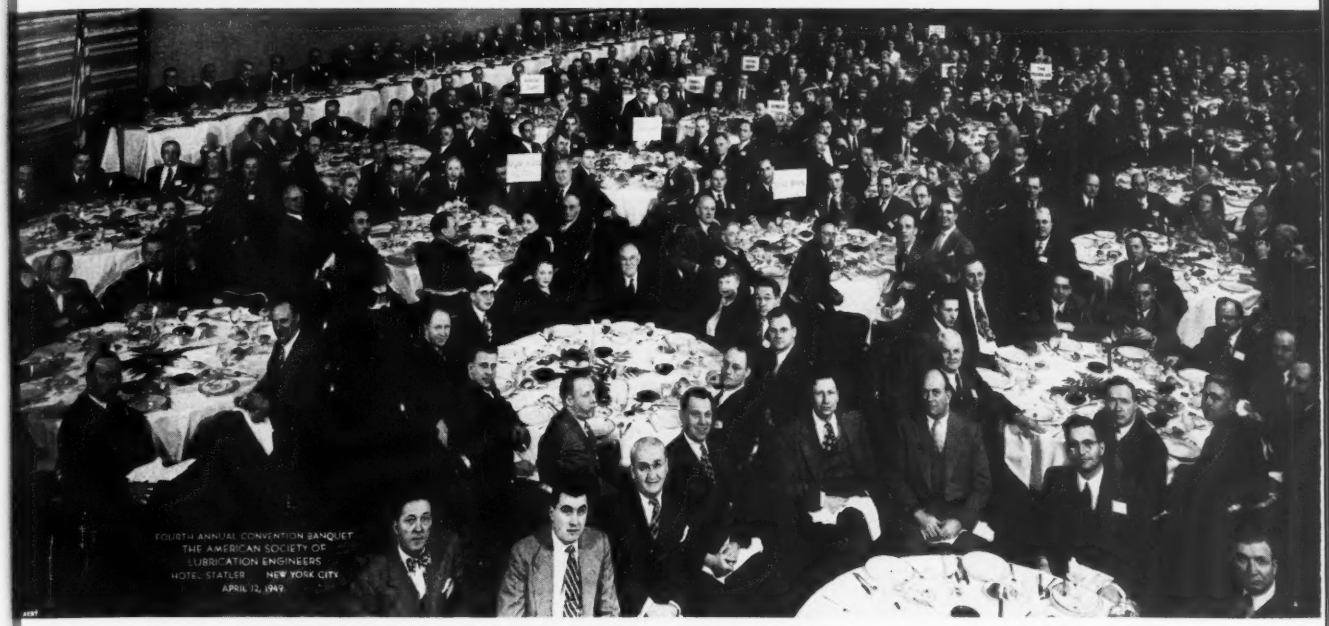


FOURTH ANNUAL A.S.L.E. BANQUET HIGHLIGHTS, HOTEL STATLER, NEW YORK CITY, APRIL 12, 1949

The Captain Alfred E. Hunt Memorial Medal established in commemoration of the memory of Alfred E. Hunt, Aluminum Company of America, was awarded to Mr. C. L. Pope, Eastman Kodak Company, for the best paper relative to lubrication offered during the year.

The A.S.L.E. Annual Award signifying life membership in the Society for the individual contributing most to the furtherance of the science and practice of lubrication, was given to Mr. Charles F. Kettering, General Motors Corp. In his absence, Mr. L. A. Danse of G. M., accepted the Award for Mr. Kettering. Speaker of the evening was Mr. E. L. Shaner, Chairman of the Board, The Penton Publishing Co., Editor-in-Chief of Steel Magazine.

E. L. SHANER

Mr. Shaner said that the world's most difficult lubricating problem is that of reducing friction, not between shafts and bearings, but between nations, so that the people can live in peace.

The North Atlantic Charter will serve notice to all nations that the United States and her allies will act promptly in case an aggressor attacks without just cause. It should prevent in the future such incidents as the overrunning of Ethiopia, the Saar and Manchuria, which led to World War II.

However, the North Atlantic Charter probably will require substantial financial underwriting by the United States. If so, we must cut other government expenses to compensate for this new burden.

As citizens we must insist that our representatives in Washington trim our budget to the things we really need and can afford. Economy in government is absolutely essential if our nation is to remain strong enough to lead the world to peace.

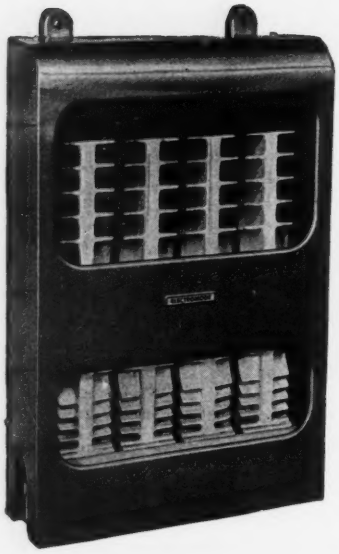
PHIL SWAIN

"Physchological Lubrication—Or How to Slide Through Life" was the subject of Phil Swain's address at the Welcome Luncheon of the Fourth Annual Convention of A.S.L.E. Doctor (of engineering) Swain is Chief Editor of two McGraw-Hill magazines, Power and Operating Engineer—also a director of the McGraw-Hill Book Co.

In his extremely informal talk, Dr. Swain said that neither a lubricating engineer, or any kind of engineer, could accomplish much or advance far personally without mastering the art of cooperating with other people—fellow engineers and non-engineers.

High spots: Learn to speak and understand the language of the other fellow, particularly of the non-engineer. Get away from the engineering jargon "gobbledegook" and use the simple everyday words. Any man you meet knows something you don't know. Why not recognize that fact tactfully and thus gain his good will and cooperation? Ability to use the language can easily be worth $20,000 to $100,000 in any engineer's professional life.

NEW PRODUCTS and EQUIPMENT

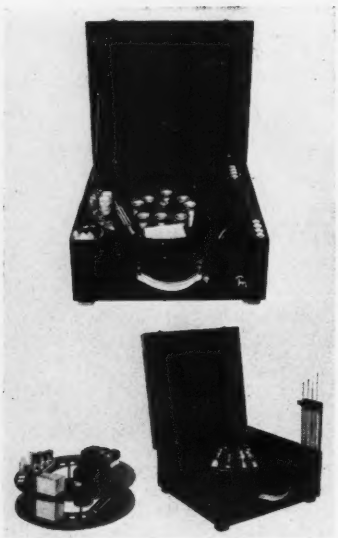


EXPLOSION-PROOF HEATER

Heating hazardous locations safely, efficiently, and at reasonable cost is the claim made by Electromode Corporation for their new all electric explosion-proof heater, complying with Underwriters' Laboratories Class 1, Group D, Hazardous Locations. Especially designed for atmospheres containing gasoline, acetone, benzol, solvent vapors and natural gas. The new heater incorporates a cast aluminum metal connection, safety grid, with nickel chrome resistor wire. Finished in silver grey hammertone. For detailed information, literature, and sources of supply, write the manufacturer. Electromode Corporation, 45 Crouch Street, Rochester 3, New York.

TRICO IN ACTION

We are in receipt, this morning, of a new bulletin entitled "On The Job Proof," by the Trico Fuse Mfg. Co., of Milwaukee. This attractive booklet shows installations on operating machinery and illustrates different applications for their product. It is profusely illustrated and includes examples of constant level, wick, thermal, and gravity feed, oilers, and the illustrations cover a wide range of industrial applications. A free copy can be had by writing Trico Fuse Mfg. Co., 2948 North 5th Street, Milwaukee 12, Wisconsin.



OIL TESTING KIT

To provide means for quick and simple measurements of the condition of lubricating oil, the Gerin Corporation, of Red Bank, New Jersey, has added a new equipment kit to its line of oil testing sets. This outfit is especially designed for use by mechanics and engine attendants in garages, power plants, and railroads.

Aside from the speed with which tests can be made, the unusual feature of the new product is the accuracy of the results obtained by the relatively unskilled employe.

The equipment kit, which is portable, measures the four dangerous classes of contaminants: 1. Change in viscosity due to fuel dilution or other causes. 2. Amount of the asphaltic and other oil breakdown substances considered responsible for deposits. 3. Amounts of dirt, metal particles, other solids and water. 4. Acidity, showing whether corrosion is possible.

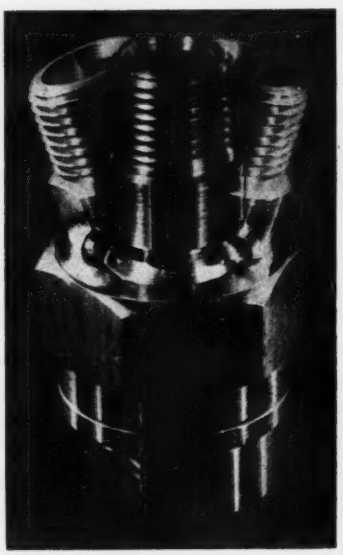
The oil from four engines can be analyzed for all four classes of contaminants in twenty-five minutes, so that changes and trends can be detected which give advance information that mechanical or operating troubles are in the making. The tests are also a necessary guide to making oil and filter changes according to time or mileage. Availability immediate. Descriptive literature on request.

SWIVEL COUPLING

Kelite Products, Inc., of Los Angeles, is producing a new swivel ball joint coupling based on a new principle for which patents are now pending. The Kelite Swivel Ball Joint will turn 20° in any direction with no restriction of flow regardless of angle. This new coupling makes it possible to absorb vibration and movement in all installations where pipe cannot be rigidly supported. The "O" ring principle provides a positive seal against leakage at any pressure. The greater the pressure, the tighter the seal, yet free movement is maintained at pressures far beyond normal requirements.

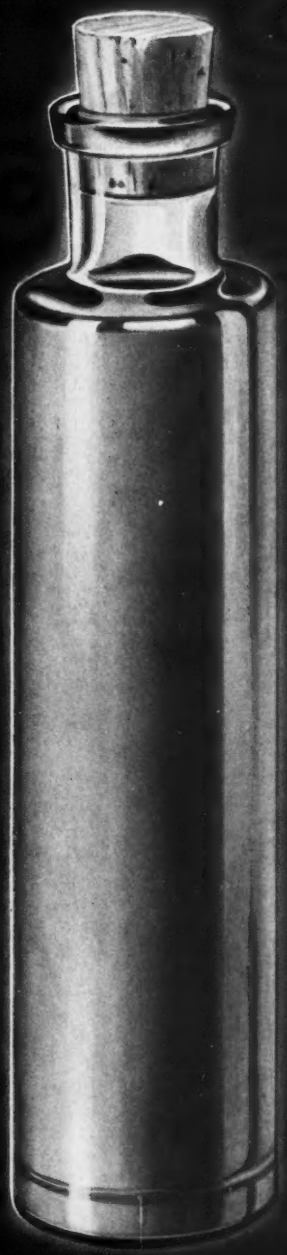
The standard ⅜ inch Kelite Swivel Ball Joint is good for pressures from ¼ ounce to 150 lbs. PSI, and for temperatures up to 350°F Models for any size pipe and for higher pressures and temperatures are available.

Complete details will be supplied by Kelite Products, Inc., Box 2917 —Terminal Annex(Los Angeles 54, California.



N.L.G.I. FALL MEETING

The next annual meeting of the N.L.G.I. will be October 3, 4, 5, 1949 at the Hotel Roosevelt, New Orleans, Louisiana. Mr. Harry F. Bennetts, Secretary of the organization, reports that their advance registration is the highest in the history of the organization. Don't forget the date—October 3, 4, 5.



Aerolube* 70

Cyanamid's New All-Chemical Motor Oil Additive

*Reg. U.S. Pat. Off.

When Performance Counts
... Call on Cyanamid

Write for information on AEROLUBE 70.

AMERICAN Cyanamid COMPANY
PETROLEUM CHEMICALS DEPARTMENT, DIV. D
30 Rockefeller Plaza, New York 20, N. Y.

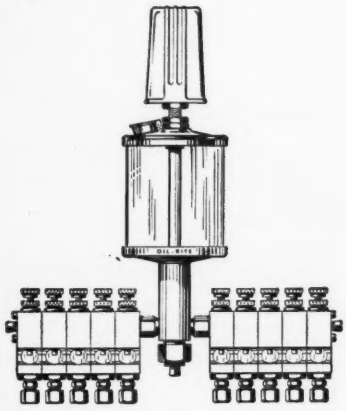
ELECTRO-OILER

Oil-Rite's latest addition to their line of lubricating devices is an Electro-Oiler which is entirely automatic in operation. Oil is released from the reservoir by a solenoid operated valve through single or multiple sight feed valves to a number of individual bearings to be lubricated.

The solenoid is connected across the line of the driving motor of the machine whose bearings are to be lubricated. When the motor switch is turned on, lubrication of the bearings starts immediately. There is no toggle to be turned on or off, and the single reservoir will feed up to 24 bearings thus replacing many individual oilers. The one reservoir can be filled quicker than many small oilers and the oil fed to each bearing can be conveniently and individually adjusted as well as observed at one station through the sight feed valves.

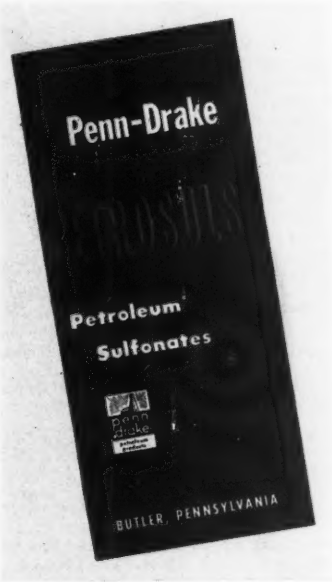
Smooth easy hair-line adjustments on each feed valve can be made and retained through the use of a friction screw. The screw can be locked against severe vibration.

APPLICATION: For—Machine Tools, Punch Presses, Printing Presses, Conveyors, Chain Lubrication, Etc.



CONSTRUCTION: Special care has been exercised in selecting a solenoid which is dependable, trouble free and long lasting. It can be operated continuously without overheating, and is mounted in a manner to make wiring easy. The enclosing box can be removed without disturbing the wiring. The oiler can be operated manually in case of power failure.

Standard models are available in five body sizes with capacities from 9 ounces to 1 gallon, up to 24 feeds, for standard voltages and frequencies. The central method of automatic lubrication offered by this oiler, its dependable performance and attractive appearance should bring it wide favor among users. For further inforation write: Oil-Rite Corp., 3428 South 13th St., Milwaukee 7, Wis.



PETROSULS

Pennsylvania Refining Company has announced publication and distribution of new descriptive literature for PENN DRAKE PETROSULS (petroleum sulphonates).

A six-page lithographed pamphlet traces the development of PETROSULS during the past war, lists specifications and states that the product possesses innumerable crucial war-proven industrial applications. Emphasis is placed on the importance of PETROSULS as a class of very efficient surface active agents. Although they are not claimed as a "cure-all" for every industrial surface active problem, they excel as the primary surface active agent and upon this foundation many formulations can be developed possessing innumerable and heretofore unobtainable properties.

PENN DRAKE PETROSULS are oil-soluble petroleum sulphonates or "mahogany soaps." Explicitly, they are sodium salts of the sulfonic acids formed during the special treatment of selected, high-quality petroleum distillates with oleum.

PETROSULS are produced in seven grades of various compositions, properties and surface tensions. Available in low and high molecular weights, they possess high oil solubility, surface active properties and stability characteristics which are most important in the development of top quality finished products.

PETROSULS are widely used in rust preventive compounds and soluble oils as mentioned in detail in the pamphlet.

For copies and information, write to the nearest office of Pennsylvania Refining Company at, Butler, Penna; Cleveland 4, Ohio; or Edgewater, N. J.

OIL PILOT VALVES

A new line of oil pilot values is now offered by Gerotor May Corp. Known as the Series 7000, they are used for remote control of oil pressure operated 4-Way hydraulic valves.

Operational Control is gained in Gerotor oil pilot valves by a fork lever design, which, when actuated by a moving part of the device being powered, permits the remote reversing of the main 4-Way valve. Both fork lever and fork and hand lever types are supplied. The latter permits manual interruption of the cylinder's forward or return stroke at any time.

25 models, including solenoid operation, are illustrated and described in catalog section 201. Copies may be had by writing Gerotor May Corp., Baltimore 3, Md., and mentioning this magazine.

ALOX BULLETIN

Technical Bulletin #3 published by the Alox Corporation, 3948 Buffalo Avenue, Niagara Falls, N.Y., gives the physical and chemical properties, also suggested uses of a group of surface active agents—known as Alox 350 which is effective in the control of corrosion in: Internal Combustion Engines, Hydraulic Systems, Turbine Systems and in handling or storage of fabricated steel parts.

(*Continued on page* 155)

CURRENT LITERATURE

Journal of the Institute of Petroleum, Vol. XXXIV, No. 297, September, 1948

THE PRODUCTION OF OLEFIN-POLYMER LUBRICATING OILS OF SATISFACTORY OXIDATION STABILITY
Dazeley, G. H., Gall, D. and Hall C. C.—pp. 647-653

Attempts have been made to increase the oxidation stability of olefin-polymer lubricating oils derived from the products of the Fischer-Tropsch synthesis. A controlled hydrogenation of the oils in the presence of a molybdenum disulfide catalyst at 200°C. and 200 atmosphere pressure yields an oil with an oxidation number of 1.8. The effect is the result of saturation by hydrogen coupled with the formation of sulfur-containing inhibitors and can be accurately reproduced by hydrogenation in the presence of nickel catalysts followed by heating with molybdenum disulfide in the absence of hydrogen. Treatment of the oil with aluminum chloride at 180°C. produces some improvement in oxidation stability, but the effect is small and is accompanied by a serious loss of oil. Naphthalene added to the olefins before polymerization is chemically incorporated in the resulting oil and leads to an increase in oxidation stability, an increased conversion of the olefins to lubricating oil, but a decrease in the viscosity index of the oil.

THE IMPORTANCE OF CHEMICAL ATTACK IN THE LUBRICATION OF METALS
Bowden, F. P.—pp. 654-658

THE LUBRICATION OF METALS BY COMPOUNDS CONTAINING SULFUR
Greenhill, E. B.—pp. 659-669

THE LUBRICATION OF METALS BY COMPOUNDS CONTAINING CHLORINE
Gregory, J. N.—pp. 670-676

The object of the first article is to emphasize one point in the theory of bondary lubrication: that is, the importance of chemical attack of the metallic surface. The action of fatty acids in lubricating metal surfaces bears some resemblance to that of the so-called "extreme pressure" lubricants in that chemical attack of the surfaces is important. Second article. The author describes an attempt to investigate the mechanism of the action of extreme-pressure lubricants using sulfur-containing compounds of known composition and structure. The third article deals with the lubricating properties of artificially produced chloride films, and of certain organic compounds containing chlorine which decompose at elevated temperatures in a known manner.

VISCOSITY AND SHEAR ELASTICITY MEASUREMENTS OF LIQUIDS BY MEANS OF SHEAR VIBRATING CRYSTALS
Mason, W. P.—p. 267A
(J. Coll. Sci., Vol. III, 1948, pp. 147-162)

Viscous and shear waves set up in certain crystals provide a means of measuring the viscosity and shear elasticity of liquids in which the crystals are immersed. A short mathematical section is followed by a description of methods of making torsional crystals of quartz and ammonium dihydrogen phosphate. The experimental method of measuring viscosities is described, and some experimental results are given. Liquids, which have been tested include polymerized oils, polyisobutylene, arocblor, and silicone putty.

THE CRAGOE L FUNCTION FOR THE VISCOSITY OF OILS UNDER PRESSURE AT CERTAIN TEMPERATURES
Dow, R. B.—p. 267A
(J. Coll. Sci., Vol. III, 1948, pp. 99-109)

An equation for the viscosity of an oil is given which involves two constants and the Cragoe viscosity function. Two equations for the temperature and pressure coefficients for the latter are also given. Discussing the results obtained for twelve petroleum oils by applying the given equation the author interprets the logarithmic equation for Cragoe viscosity function in terms of current reaction-rate theory and suggests that orientation effects during viscous flow are probably responsible for the discrepancies between theory and experiment.

MACHINE FOR TESTING GEAR MATERIALS AND LUBRICANTS
Anon.—pp. 268A-269A
(Machinery, Vol. LXXII, May 13, 1948, p. 593

The article describes a machine developed by Messrs. David Brown & Sons (Huddersfield) Ltd. for the testing of gear materials and lubricants, and known as The Self-Aligning Disc Machine.

PENETROVISCOMETER FOR VERY VISCOUS LIQUIDS
Bikerman, J. J.—p. 269-A
(J. Coll, Sci., Vol. III, 1948, p. 85)

The instrument is described which consists essentially of a glass tube containing the test material, through which a weighed brass plunger is allowed to fall. The descent of the plunger is observed by means of a low-power microscope. The theory of the instrument is worked out, and expressions for the viscosity of the test material are deduced in terms of the rate of fall of the plunger, the dimensions of the tube, and the load on the plunger.

EFFECT THE CONSISTENCY CURVE HAS HAD ON DEVELOPMENT OF MODERN VISCOMETERS
Green, H., p. 269A
(J. Coll. Sci., Vol. III, 1948, pp. 129-133)

Studying the consistency curve (a hyperbola containing four variables) shows that for all except Newtonian liquids one should use a rotational viscometer, which gives a linear consistency curve when laminar flow sets in. The rotational viscometer can also be used in measurements of thixotropic systems.

MOLECULAR ADSORPTION AND SURFACE STATES IN LUBRICATION
Trillat, J. J.—p. 270A
(Bull. Assoc. franc. Tech. Petrol, 1948 (69) pp. 17-44)

The first part of this lecture deals with the influence of the molecular structure of the oil on adsorption. The measurement of the interfacial tension between oil and water (whcih can indicate the concentration of polar additives in the oil) is described. In the second part of the paper the influence of the surface structure of the metal is discussed. For a reduction in the coefficient of friction to occur, the presence of moisture is essential. A metal surface freshly prepared under vacuum exhibits highly accentuated adsorption properties. Brief mention is made of the use of radio-active tracers in the study of adsorbed oil films.

Vol. XXXIV, No. 298, October, 1948

FUNDAMENTAL WORK ON FRICTION, LUBRICATION, AND WEAR IN GERMANY DURING THE WAR YEARS
Tingle, E. D.—pp. 743-774

This is BIOS Final Report No. 1610. This report gives an outline of fundamental work on friction and lubrication carried out in Germany during the war years, 1939-1945. The discussion which follows (pp. 772-774) outlines some of the specific researches. After some general considerations, the author discusses: 1) the mechanism of friction and lubrication; 2) the mechanism of wear and dry friction; 3) lubricant testing on various apparatus, and 4) oil deterioration.

MAJOR DEVELOPMENTS IN SYNTHETC LUBRICANTS AND ADDITIVES IN GERMANY
West, H. L.—pp. 774-820

This is BIOS Final Report No. 1611. The investigation into the German oil industry has shown that the Germans had a well-developed synthetic oil industry. The first part of this report deals with both hydrocarbon synthetic and non-hydrocarbon synthetic lubricants. The second part is devoted to the practical application of synthetic lubricants, including cold-corrosion prevention oil ("fly-away oil"), jet-engine lubricants, industrial lubricants, special aircraft lubricants, automobile-engine lubricants, and greases.

MODERN LUBRICATING OILS
Kasinski, B.—pp. 316A-317A
(Nafta, Vol. IV, Feb., 1948—pp. 68-71

Reprinted from Przegląd Motoryzacyjny, June, 1946, the paper describes modern methods of improving viscosity, viscosity index, lubricating properties, stability, oxygen resistance, corrosiveness, prevention of emulsification, and de-waxing, of lubricating oils. A comparison between lubricating oils used in the U.S.A. before the war, at present, and those of the future is included at the end.

REPORT ON WORK OF LIQUID FUELS AND LUBRICANTS COMMITTEE OF THE POLISH STANDARDIZATION COMMISSION FOR THE YEAR 1948
Anon.—p. 317A
(Nafta, Vol. IV, Feb., 1948—p. 78

Twelve sub-committees covering different groups of products submitted their reports at the end of 1947 to the Editorial Committee. These will be published as separate pamphlets which will make any changes easier. For 1948 it is planned to publish new methods of testing.

DOPED MOTOR OILS
Stillebroer, C.—p. 317A
Ingenieur, Vol. XXXIV, Aug. 20—1948
Mk—pp. 95-99

The results of adding detergent dopes to motor oils is discussed.

Lubrication, Vol. XXXIV, No. 9, September, 1948

HIGH SPEED BALL BEARING LUBRICATION
Anon.—pp. 97-108

The ways and means of insuring positive lubrication to ball-bearings of high-speed machinery are taken up. Methods of lubrication by means of oil and grease are discussed. Oil mist systems, lubrication by means of oil slingers, types of oil and grease used, controlled oil supply, effect of dirt, and proper sealing are covered.

Petroleum, Vol. XI, No. 12, December, 1948

BLENDING TECHNIQUES. THE USE OF TEMPERATURE - VISCOSITY AND BLENDING CHARTS
Steinitz, E. W.—pp. 269-271

The two main problems confronting the blender of lubricants are first to determine the viscosity of his basic oil and secondly to predict with as little laboratory work as possible the viscosity of his final mixture from a knowledge of the viscosities and proportions of the components. The author outlines some practical methods of solving these problems.

Vol. XII, No. 1, January, 1949

COMMERCIAL GLYCOLS
Anon.—p. 19

The commercial production of three new glycols has been announced from America; they are butanediol-1, 3; 2-methylpentanediol-2, 4; and octylene glycol. The properties of butanediol and the uses of the glycols in question are indicated briefly.

LABORATORY GREASE MAKER
Anon.—p. 19

An oil-heated kettle has been developed by engineers of the Texas Co., which reduces the time necessary to make lubricant greases for research and testing. By permitting close temperature control, it provides a high degree of accuracy in reproducing products. All possibility of loss of ingredients, or contamination is avoided by eliminating a draw-off-valve.

Petroleum Engineer, Vol. XX, No. 3, December, 1948

HISTORY AND ANALYSIS OF BUREAU OF MINES' PETROLEUM AND NATURAL GAS DIVISION
Adams, E.—pp. 41-48

This first part of a series of articles on the Petroleum and Natural Gas Division of the Bureau of Mines covers the historical outline of the activities of the Bureau of Mines, its organization and its cooperation with the oil industry. The chart is presented showing Federal agencies concerned with oil and gas activities, including various departments and commissions.

HYDROCARBON ABSORPTION AND FRACTIONATION PROCESS DESIGN METHODS. PART 17. FLUIDDYNAMICS OF BUBBLE PLATE COLUMNS
Edminster, W. C.—pp. 193-198, 200

In this installment the author discusses the calculation of the number and type of bubble trays, the plate spacing and column diameter. Such calculation involving considerations of fluid flow and the interphase transfer of heat and material, are discussed. Approximate calculation methods for bubble plate pressure drops are included.

UNION DEVELOPS SHALE OIL RETORTING METHOD
Reed, H. and Berg, C.—pp. 214, 216, 218

The shale oil reserves of the United States are conservatively estimated to constitute over 100 billion barrels, of which almost 50 billion are recoverable in Colorado alone. Union Oil Company is carrying on an extensive program to develop processes for retorting shale and refining the extracted oil. Details of the Union Oil retort, and its operation are taken up, and the description to a 50-ton per day semi-commercial unit is presented. Retorting characteristics of various shales are covered.

Petroleum Refiner, Vol. XXVII, No. 12, December, 1948

ACIDS CAUSE ENGINE WEAR
Anon.—p. 83

Popular thought to the contrary, friction is not the major cause of automobile engine wear, according to recent discoveries of Shell Oil Company researchers. Instead, the action of acids, resulting from low operating temperature, has been found to cause most engine wear. When the engine is intermittently on and off, it runs "cold," with the result that combustion may be incomplete and partly burned fuel gases and moisture attack the smoothly polished metal surfaces chemically. It is this type of acid action that accounts for up to 90 percent of engine wear. If acid action can be prevented, years will be added to the life of the engine.

Petroleum Times, Vol. LII, No. 1340, December 17, 1948

CALCULATION OF THE VISCOSITY OF OIL BLENDS
Roegiers, M., and Roegiers, L.—pp. 1091, 1106

The authors present their investigations on the viscosity of ideal mixtures of oils. The original monograph "Viscosity of mixtures of normal fluids" (in French) was published in September, 1947, by the Elektrion Oil Laboratories (Coupure 221), Ghent, Belgium, and contained 47 pages. The calculation of viscosity of oil blends by means of a special abacus is described which is based on two equations.

Plant Engineering, Vol. II, No. 8, August, 1948

SELECTION OF GREASES FOR GENERAL PLANT USE
McConville, H. A.—pp. 16-17

A list of the greases considered essential for the average plant would include a motor ball and roller bearing grease, a cup grease and a grease for pressure lubricator or one shot systems. Other greases which might be desirable are a high temperature grease, a waterproof grease and possibly one or two graphite greases. For special applications a low temperature grease might be added. A chart shows the properties that might be expected from the various greases.

HOW DO YOU BUY LUBRICANTS?
Anon.—pp. 40-41

Some plants have set up lubricant specifications to get cheap products. Physical properties alone cannot be relied on however. There is a difference between specifications for cheapness and getting maximum performance designed, not to any given standards, but to give the best returns from a standpoint of cost per unit produced or cost per year of the machine. Physical specifications cannot be accepted as a measure of lubricant quality. Rather they set up minimum requirements. A low priced hydraulic oil used in a certain industry was found to operate a machine tool for 1500 hours before the saturation point of the oil was reached. In the same machine tool on the same work, the same operator, a treated hydraulic oil was found to operate 3250 hours before like deterioration occurred. The specification hydraulic oil was 27 cents per gallon. The premium oil was 64 cents per gallon. The cost per hour of the premium oil was $0.00689 as against $0.0063 for the specification oil. For the additional cost of $1.23 per year many advantages in quality were obtained.

Revue De L'Institut Francais Du Petrole Et Annales Des Combustibles Liquides, Vol. III, No. 6, June, 1948

EXPERIMENTAL METHODS OF STUDYING THE ACTION OF ADDITIVES TO LUBRICATING OILS IN EXTREME PRESSURE LUBRICATION
Courtel, R.—pp. 171-180

The author points out the necessity of studying the mechanism of the action of extreme pressure additives to lubricating oils. The analysis presented does not pretend to be complete, it tends only to show how the matter stands now, particularly when considered from a scientific standpoint. Results of a number of experimental investigations published in English since 1940 are discussed briefly. A brief account is also given of some experimental studies recently made in France on the same subject.

Vol. III, No. 7, July, 1948

STUDYING THE LUBRICATION OPERATION; LUBRICATED FRICTION OF POLISHED BEARINGS
Leloup, L.—p. D109
Rev. Univ. Mines, Vol. III, No. 10, 1947

The functioning of a bearing is discussed when the coefficient of friction reaches its minimum value. The expression for the "critical value" varies depending on the ratio of the length to the diameter of the bearing and decreases when the polish of the surfaces becomes more perfect. "The critical value" does not depend on the properties of the lubricant other than its viscosity.

Vol. III, No. 8, August, 1948

THE RULER FOR THE CORRECTION OF THE VARIATIONS OF THE DENSITY OF LIQUID HYDROCARBONS AS A FUNCTION OF THE TEMPERATURE
Reis, T.—p. 119
(Publications Techniques et Scientifiques de l'Ecoel Francaise des Ingenieurs de Beymouth. No. 10, 1945, 20 pages)

A ruler is described which allows the determination of the correction of errors which enter into calculations of the variations of the density of liquid hydrocarbons when applying the "standard" method and using the tables.

TWO HEAT-RESISTANT LUBRICANTS
Sumner, G. L.—p. D-125
(Westinghouse, Eng., 1947, Nov., pp. 188-189)

Two compounds, molybdenum sulfide and boron nitride, are used for two years by the Westinghouse Electric Corporation as heat-resistant lubricants. The former reduces the friction of steel surfaces at high temperature and can be incorporated easily in the normal lubricants (oils and greases) and in silicones. The latter (known under the name of "white graphite") is used as an addition to silicones. The price of the compounds is indicated.

NEWS OF THE SECTIONS

CHICAGO

The Chicago Section has put on a membership campaign, which has proven highly successful. At the March meeting, the Vice Chairman, Mr. Robert A. Kraus—in the absence of Mr. Schmitz, announced the excellent progress of the membership drive. New tags imprinted with "I gotta new member, Didju," were distributed to all members bringing new candidates for admission. Mr. Chas. L. Pope of Eastman Kodak Company presented an excellent paper entitled "Increasing Profits From Systematic Lubrication." Mr. Kraus' comments follow: "In his paper, Mr. Pope indicated that 'at present there is no adequate training program for lubrication engineers' but that 'several schools are now devoting greater portions of their curricula to lubrication subjects and that there was promise that future years may see full-fledged lubrication engineering graduates capable of handling all phases of this specialized field of endeavor.' This would be in contrast to many of our present-day lubrication engineers. In later portions of his very informative paper, Mr. Pope cited many examples of costly errors initially caused by inadequate knowledge of the subject at hand which resulted in a necessarily decreased profit to the company involved. Examples included installations where 'excessive gasket material surface was exposed to the oil which resulted in oil failure due to the corrosive nature of the gasket material.' Mr. Pope here cited the fact that practically all known gasket materials decompose into corrosive substances in the presence of oil and when excessive surface areas are presented to the oil, such as with full face end gaskets, etc., the decomposition rate is accelerated to the point where damage may result to finished surfaces through corrosion.

"Other examples included designs incorporating inadequate provisions for expansion with resultant high thrust loads and subsequent failure, the possibilities of electrolysis across oil films at bearings, grease bleeding tests and their importance, interpretation of interfacial tension tests in the light of new inhibited oils, and many similar problems coupled with possible damage that can result if not properly taken care of.

"Problems that have resulted from the use of lubricants by well-intentioned employees in making application where they can actually cause damage was brought out. An instance where a soap-thickened lubricant, which previously had proved very successful on another application, was used on wick feed oilers on a whole department of punch press crankshafts. The result was the wicks plugged solid and caused several thousands of dollars of direct damage, not including the lost production in that department.

"The discussion after the paper was also quite lively with considerable emphasis being placed on the status of the oiler in the modern maintenance picture. Many companies have apparently recognized the value of increasing the job quality of oiler personnel to take maximum advantage of the benefit to be gained thereby."

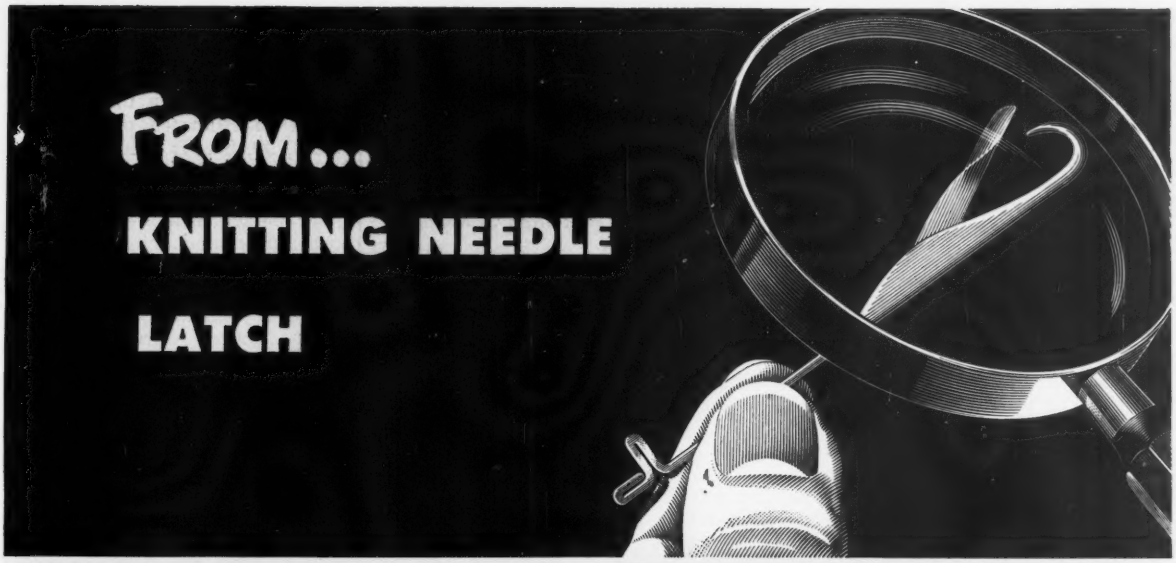
Mr. Charles F. Garney, Secretary of this Section, submitted the following fine synopsis of their April meeting: "Mr. J. J. Slomer, Manager of the Hydraulic Division, Goodman Manufacturing Co., presented a very informative paper on 'The Lubrication of Mining Machinery and the Application of Hydraulics.' Mr. Slomer traced the modification in lubrication practices which have been made over the years in the lubrication of this extremely rugged type of equipment. Specifically, the trend had been to the use of lighter bodies lubricants to replace semi-fluid greases and heavy bodied cylinder oils which were used extensively years ago. Actual service records in the field have proved that the lubricant which should be used is the lightest bodied lubricant which will provide an adequate film to protect bearings and gears. The advantages of such practices are lower operating temperature, lower power consumption, and immediate protection from the instant the unit is started. Mr. Slomer discussed the application of hydraulics to mining machinery from the standpoint of simplifying the job of the maintenance man. Instruction manuals which are now being furnished, make it possible for the maintenance man to follow fluid flow easily and to understand clearly the function of each component of the system. He pointed out that by taking the mystery out of hydraulic circuits, the necessity of factory trained experts on hydraulic system troubles has been virtually eliminated."

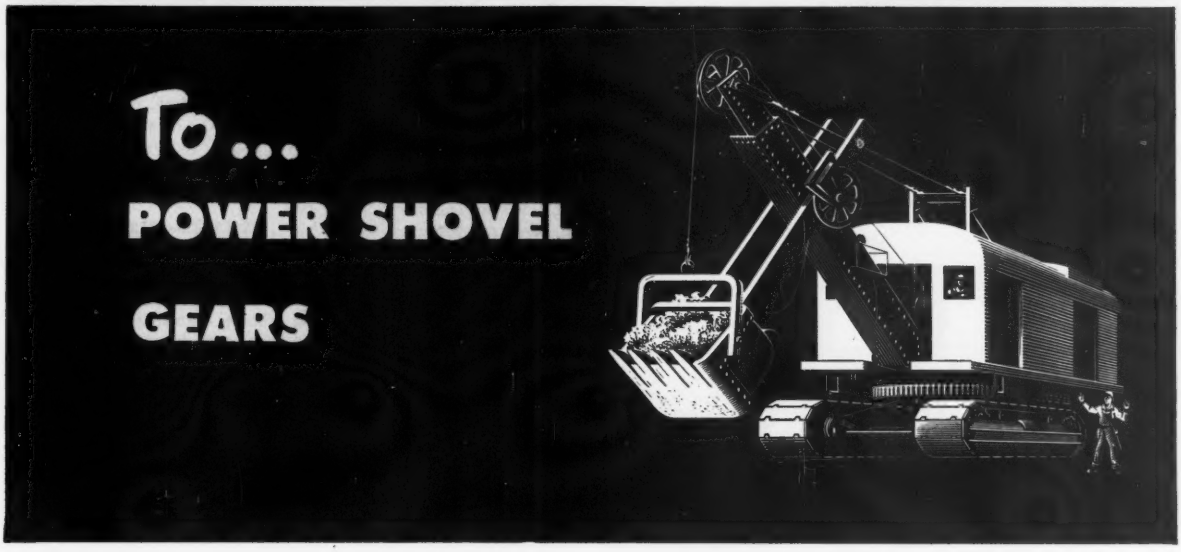
LOS ANGELES

The Los Angeles Section elected Mr. Arthur M. Montzheimer as its field editor for their Section. His first report of the April meeting is an excellent one and we quote: "An instructive and interesting film, 'More Things For More People,' by the Kaiser Company, opened the April meeting. This was followed by an excellent discussion of steel mill lubrication presented by Mr. James H. Frier, Section Vice-Chairman, and Chief Lubrication Engineer of the Kaiser Company's Fontana, California, steel mill. The colored sound film dramatically depicted the romance and importance of the far west's first completely integrated steel mill. The picture showed operations all the way from the Kaiser coal and iron ore mines, on through the coking and by-product plants, the 1200-ton per day capacity blast furnace, the open hearths, blooming, merchant, plate, skelp, pipe, shape and strip mills, to the shipping of the completed steel products to fill the ever-increasing needs of western consumers. The film left little to one's imagination as to the importance and necessity of having one of Mr. Frier's capabilities as lubrication engineer in this modern Fontana steel mill. Mr. Frier's subsequent detailed description of the more important and unusually difficult lubrication applications of many varieties, where adverse and difficult operating conditions are often encountered, gave the audience an insight into his wide experience in lubrication matters in all phases of a large steel mill such as the Kaiser Company's Fontana mill.

Though his discussion was a relatively non-technical one, he pres-

(*Continued on page* 147)





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A.S.L.E. Membership Requirements

Membership in the Society is in several grades as defined below. Assignment to grade is made by the Admissions Committee or Board of Directors on the basis of information submitted or supplied by references.

MEMBERS—$12.50

Members shall be: (1) persons not less than twenty-four years in age who are engaged in research and instruction at technical schools, universities and various publicly and privately supported institutions in the field of lubrication; or (2) persons not less than twenty-four years in age who have occupied recognized positions as Lubrication Engineers for a period of three or more (not necessarily consecutive) years prior to date of admission, involving the responsibility for or supervision of the development, selection, field use and application of lubricants as differentiated from other activities; or (3) persons not less than twenty-four years in age who are indirectly concerned with the field of lubrication, but possessing other qualifications of experience, knowledge and accomplishment, have manifested a particular interest in the purposes and welfare of the Society, to the extent that their membership would be a valuable contribution to the successful functioning of its activities.

JUNIOR MEMBERS—$6.25

Junior Members shall be: persons less than twenty-four years in age, and those who do not completely fulfill the membership requirements for Members.

INDUSTRIAL MEMBERS

Industrial members are such persons or organizations as may be interested in and desire to contribute to supporting the purposes and activities of the Society. The fees paid by an industrial member in general will not be allowed to exceed $200.00 per year.

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*Denotes Residence Address Preferred.

News of the Sections

(*Continued from page* 144)

ented a multitude of valuable details regarding the type of lubricants employed, the method and frequency of application, and the measures taken to maintain these lubricants and lubricant systems in the best operating conditions. He touched briefly on their company's use of various charts, records of equipment, materials, and frequency of lubrication applications, code designations and cost records and control. Mr. Frier's presentation was so complete and well presented that very few questions remained to be brought up in the discussion period that followed."

Mr. George L. Sumner, Materials Engineer for Westinghouse Electric Corp., and 1948-49 President of A. S.L.E., spoke before this Section at their May meeting on "Greases and Their Evaluation." Mr. Sumner brought to the Section a summary of the recent National Convention held in New York, and was able to make many constructive suggestions on membership growth in A.S.L.E.

Thanks to Mr. E. E. Perso, Section Secretary. This brief report just made our deadline.

PITTSBURGH

In place of the regular March meeting of this Section, the Program Chairman, Mr. George L. Sumner, Jr., arranged a very interesting and educational inspection trip through the Gulf Research and Development Corp. Laboratories at Harmarville, Pa. During the tour an opportunity was given to see how octane numbers of gasoline were obtained both by motor method and research method. The department, where all types of engines are continuously being tested with motor oils proved extremely interesting and in particular, some of the new high compression engines which are appearing on the market. Considerable interest was shown in a Pratt & Whitney Aviation Engine; also, considerable interest was shown in the various parts of some of the smaller automotive engines which had completed their test runs. A demonstration of the effect of adding materials to eliminate foaming was unique. A very practical demonstration of the work done on steam turbine oils to show that they were checked for stability by means of the A.S.T.M. Oxidation test, as well as the check for rust prevention, was of particular interest to men who deal with steam turbines. Considerable interest was shown in the demonstration of cutting oil research in a most modern and up-to-date mchine shop.

We thank Mr. E. S. Reynolds, Secretary of the Pittsburgh Section, for this complete description of the plant tour.

FORT WAYNE

Mr. Frank Ross of E. F. Houghton & Co., Cleveland, presented his unusual and always popular talk on "Confused Lubrication" at the March meeting of this Section. This paper assures a lively discussion period wherever it is presented. A business meeting was held at this session, at which the same Officers were re-elected for the coming year. Mr. Ross made some valuable suggestions on methods used by other Sections in increasing membership.

Due to the absence of the Secretary, Mr. D. R. Reynolds was appointed as Secretary pro-tem, sending in the above report.

ST. LOUIS

The last two meetings of this Section aroused much interest. Mr. Franklin M. Watkins, who is in direct charge of Corrosion Control work for the Sinclair Research and Development Co., Harvey, Illinois, outlined the various types of rust inhibitors and the theory of their action. Then he discussed the results of use of certain inhibitors in gasoline, kerosene, and oils, both when transported in tank cars and pipe lines and when used in various machines by the consumer. Photographs were circulated showing the results of the use of inhibited fuel in gasoline fuel pumps, carburetors, diesel fuel injectors and oil-burner nozzels. The fact was brought out that through protection of their own equipment, the oil company as well as the consumer receives the advantage of the inhibitors.

Mr. Merrill A. Hayden, Asst. Manager, Industrial Sales Division of Vickers, Inc., whose subject was "Power Hydraulic System," stated that such hydraulic systems were used for transmission, control and applying power. He pointed out that the advantages of a Power Hydraulic System were:

1. It will stall under load without damage.

(*Continued on page* 149)

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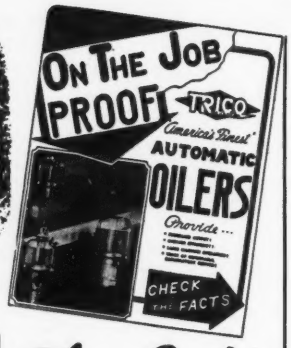

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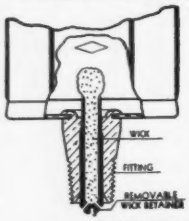

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Discussions (*Continued from page* 128)

year to meet 22 specific requirements. The average yearly maintenance cost of this group was $940,080.00 and the cost of the lubricants was $16,184.00.

By reducing the number of oils to four base stocks for the compounding of twenty-two lubricants for our specific uses, we were able to effect a yearly savings of $7350.00 in the cost of our lubricants and, by proper application of lubrication engineering, to reduce the cost of maintenance $152,865.00 per annum. The net result for this group of departments was a reduction of 45% in lubricant cost and 16% in maintenance with a total saving of $160,215.00 per year. When Research presented these data to management, a Lubrication Division of the Engineering Department became a reality and management is now receiving its full measure of lubrication engineering properly applied to all of the operating departments of the plant.

Discussion by Carl E. Schmitz

Vice President, Director of Engineering, Crane Packing Co.

Mr. Read's paper in my opinion covers an existing situation with remarkable clarity and foresight. It is a challenge to industry, large and small, to evaluate the problem of lubrication and its effect insofar as the specific industry involved is concerned.

Far beyond the savings that can be had by reducing lubrication inventories is the tremendous additional savings that can be had in maintenance costs. In my opinion the American Society of Lubrication Engineers has before it a problem of tremendous importance insofar as education is concerned. As Mr. Read has pointed out, the problem must be attacked by making top management cognizant of just how much can be saved by—

1. The employment of the proper lubricant for the job intended.
2. The overall reduction that can be effected in general maintenance by the application of proper lubrication.
3. The reduction of lubrication cost itself by the minimizing of inventory through proper selection of the lubricant for the problems in the specific plant involved.

Management today as never before is looking for ways and means of reducing operating costs. Surely here then is an opportunity for intelligent application of economies and overall improvement of operating efficiencies.

Along with the selection of the proper lubricant and a practical means of application is involved another problem, and I now refer to the proper and sensible use of seals and closures, which play an important part in keeping foreign matter from entering the lubricant and preventing excessive losses of it. In many instances the application of a proper seal will permit the use of a lubricant more readily adaptable and better qualified to do the job, since seals prevent loss and eliminate contamination. To cite specific examples—

1. A more expensive lubricant better suited to the problem can be employed and use seals to prevent the loss of the more expensive lubricant.
2. If a lubricant of lower viscosity is indicated, it can be used and loss satisfactorily prevented with seals.

Sensible lubrication is not the concern of large industry alone. Small industry can profit proportionately. I think that in addition to making industry cognizant of lubrication and what it means, it is important that some work be done to educate the general public on what lubrication means to it. The "butcher," the "baker," the "candlestick maker" are all affected, and if they can be made cognizant of the fact that improper lubrication, improperly applied and handled, makes for higher costs in their daily lives, additional impetus will be given to the importance of this timely subject.

There probably is not one organization in ten—large or small—which could tell you within 50% the amount spent for lubrication materials alone, not to say anything of the resultant loss from improperly applied and handled lubricants. As lubrication engineers, the responsibility for industrial and general public information rests squarely upon our shoulders. Progress is being made. There is much yet to be done.

It is my opinion that the American Society of Lubrication Engineers would do well to consider a publicity committee who should be active in the dissemination of information concerning lubrication and its importance to every man, woman, and child in this great country of ours. Mr. Read is to be congratulated on having presented to this body the problems faced by the great industry which he represents. We as lubrication engineers have a clear cut challenge. Are we equal to it?

(*Continued from page* 147)

2. The system is lubricated from the hydraulic fluid.
3. The operating temperature is only limited by the fluid used.
4. The weight to horse power and size to horse power is small.
5. The controls are advantageous.
6. The systems have great simplicity.

Mr. Hayden pointed out, and exemplified with slides, the many uses for Hydraulic Power Systems with machine tools, materials handling handling equipment, trucks, buses, mining machinery, oil well pumps, farm equipment, marine equipment, aircraft, and rolling mills. We are indebted to Mr. Henry M. T. Harris, Secretary of the St. Louis Section, for these excellent resumes of the papers given.

CONNECTICUT

The speaker at the March meeting was Mr. G. E. Evans, Engineering Division, Esso Standard Oil Company. In his position in the Engineering Division of their Marketing Dept., his duties have taken him throughout the United States, handling the engineering aspects of petroleum or the engineering problems associated with petroleum. Subject: "Petroleum Products Development and Test Work—Laboratory vs. Field Work." Mr. Evans discussed the significance of petroleum specifications and the tests necessary to develop products to meet these specifications. With his talk he featured the generous use of slides to illustrate the salient points of the topic. A general question period followed for those with specific problems.

DETROIT

At a recent meeting, Mr. C. R. Schmitt, Lubrication Manager of the Central Division for E. F. Houghton & Co., Cleveland, Ohio, presented a paper dealing with High Temperature Oil Lubrication. A resume of his paper follows: "A paper dealing with the past, present and future aspects of High Temperature Oil lubrication as applied to industrial equipment. Past attempts to handle lubrication at temperatures up to 400° F. were discussed and various shortcomings of lubricants illustrated. It was shown that temperatures, on the average, are being increased in excess of 400° F. and that it is necessary to produce lubricants capable of retaining their original characteristics and of protecting bearings against wear due to lack of lubrication."

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On April 25th, Mr. A. J. Zino, Jr., Asst. Sales Manager, Industrial Division, of Swan-Finch Oil Corp., New York City, spoke on the subject "What to Look For in Hydraulic Fluids." Mr. Zino's paper depicted the trend from early mechanically operated industrial equipment to the modern streamline machines, many of which are hydraulically operated. His talk explained how the various types of pumps require different types of petroleum products as the hydraulic fluid medium.

BALTIMORE

The speaker at the final technical session of the season was Mr. W. G. Perriguey of the Esso Standard Oil Co., New York City, who presented a paper entitled "Why Change Oil?" We quote from Section Secretary Staines' report: "This topic naturally created much discussion in the period following his presentation. The final conclusion and answer (if there was one) to the title of the paper, seemed to be 'Because it gets dirty'." New Officers were elected at this meeting. (See Section Officers' page)

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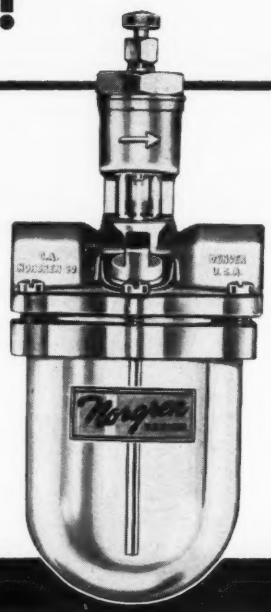

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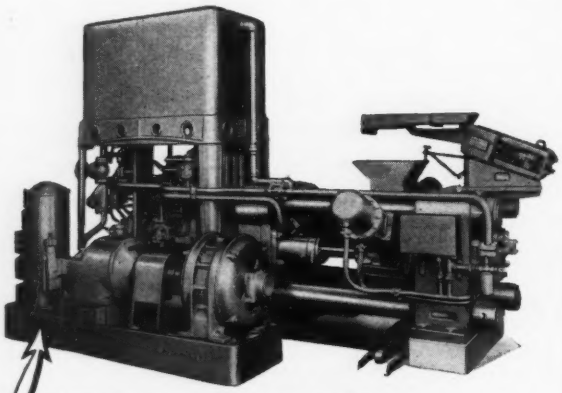

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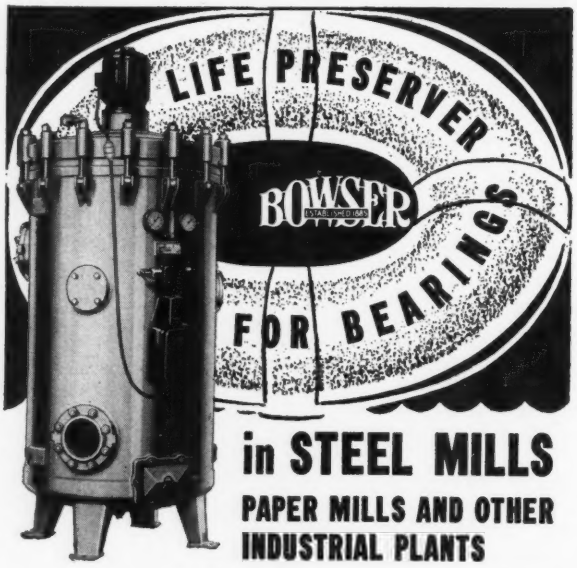

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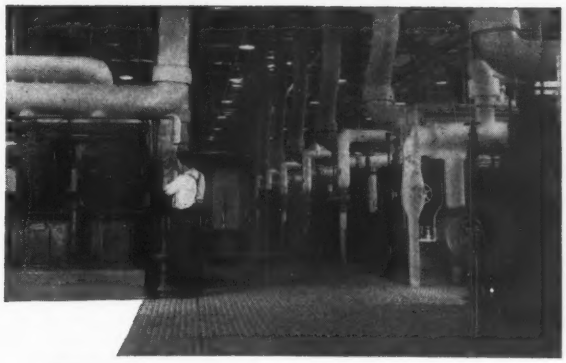

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OILS AND LUBRICANTS PATENT ABSTRACTS

Printed copies of patents are available from the Patent Office at twenty-five cents each. Address the Commissioner of Patents, Washington, D. C., for copies and for general information concerning patents.

From Official Gazette—Vol. 620, Nos. 1, 2, 3, 4, 5. Vol. 621, Nos. 1, 2, 3, 4.

Prepared by ANN BURCHICK

Purification of Glyceride Oils — Patent #2,462,923—Benjamin H. Thurman, assignor, by mesne assignments, to Benjamin Clayton, doing business as Refining, Unincorporated.

The method of purifying glyceride oils which are substantially free of gums and which contain small amounts only of impurities, which process comprises, admixing with said oil an aqueous caustic alkali refining agent having a concentration between 10° and 50° Bé and in just sufficient amounts to produce separation of impurities from the oil as part of an aqueous phase during continuous centrifugal separation of the mixture, the concentration of said agent being sufficient to prevent emulsification of the oil into said aqueous phase, whereby the resulting mixture first separates into an oil phase and an aqueous phase in a continuous centrifugal separator and then an intermediate soap phase tends to separate from said aqueous phase and partially mix with said oil phase, subjecting said mixture to said continuous centrifugal separation, and discharging said aqueous phase from said continuous separator substantially as soon as it separates from said oil phase and prior to substantial separation of said intermediate soap phase from said aqueous phase.

Resin-Oil Compositions—Patent #2,463,023—Rupert S. Daniels and William R. Catlow, Jr., assignors to Bakelite Corp.

Composition suitable for coating material comprising a composition of a fatty oil and a fatty oil-soluble organic resin selected from the group consisting of natural resins, their salts, esters and oxidation products, phenol-aldehyde resins, and coumarone resins, said oil and resin composition being in a state of non-extractability in acetone of at least 30% and of dispersibility in hydrocarbon thinner, and incorporated with said oil and resin composition a thermoplastic agent soluble in an aromatic hydrocarbon solvent and selected from the group consisting of water-insoluble cellulose ethers, polymerized esters of methacrylic acid polymerized vinyl compounds, said agent being present in proportion sufficient to impart resistance to chipping of the composition in floor and stair tread coatings of over 5 mil thickness.

Lubricant — Patent #2,463,429 — Edward N. Roberts, assignor to Standard Oil Company.

A hydrocarbon oil containing in combination therewith from about 0.001% to about 2% of a polyhydroxy aromatic compound of the group consisting of a polyhydroxy aromatic alcohol and a polyhydroxy aromatic aldehyde and from about 0.001% to about 10% of a neutralized phosphorus and sulfur containing reaction product of a phosphorus sulfide and an olefin polymer.

Greases—Patent #2,463,822—John C. Stamm, assignor to Standard Oil Co.

The method of preparing a rosin soap grease comprising heating a mixture of a hydrocarbon oil and rosin at a temperature of from about 450°F. to about 525°F. in the presence of from about 20 weight per cent to about 50 weight per cent of a sulfur bearing hydrocarbon oil for a period of time within the range of from about one hour to about 12 hours to produce a rosin oil and subsequently saponifying said mixture of oil and rosin oil.

Greases—Patent #2,463,823—Alfred W. Weitkamp, assignor to Standard Oil Co.

The method of preparing a rosin soap grease comprising heating a mixture of the hydrocarbon oil and unpolymerized rosin at a temperature of from about 350°F. to about 450°F. in the presence of from about 0.1 weight per cent to about 1 weight per cent of a catalyst selected from the class consisting of sulphur, selenium and tellurium but in the absence of a hydrogenation catalyst, for a time sufficient to produce a rosin oil having the property to produce, upon saponification, a grease having the desired setting and penetration characterists and subsequently saponifying the mixture of oil and rosin so formed with a reagent selected from the class consisting of an alkaline earth base, an alkali metal base, and mixtures thereof.

Production of Synthetic Lubricating Oil — Patent #2,463,872—Raymond L. Heinrich, assignor, by mesne assignments, to Standard Oil Development Co.

A method for producing an improved lubricating oil which includes the steps of contacting an alpha olefin under conditions suitable for polymerization with substantially anhydrous Friedel-Crafts type catalyst in the presence of an isoparaffin diluent for the reaction to form a polymer in the lubricating oil boiling range, admixing hydrogen halide with the reaction mixture to terminate the polymerization reaction and to initiate the alkylation reaction, and alkylating the polymer with the isoparaffin to form a substantially saturated product suitable for use as a lubricating oil.

Method and Means for Removing Oil and Oily Substances from Solid or Water Surfaces—Patent #2,464,204—Irvin Baker.

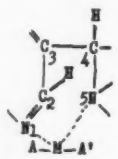
The method of removing an oleaginous substance from surfaces subject to the presence of water comprising contacting the oleaginous substance with a water insoluble powder consisting essentially of particles having a surface consisting essentially of solid carbon.

Apparatus for Testing Lubricating Oils—Patent #2,464,233—Everett C. Hughes, John D. Bartleson, Margaret L. Sunday, and Melvin M. Fink, assignors to The Standard Oil Co.

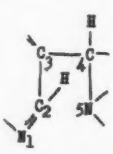
Means for testing oils, comprising a container for a sample of the oil, said container containing a sleeve providing selected catalytic surfaces and containing means for supporting within the sleeve a test piece having a bearing surface, a shaft rotatable in the sleeve and resting on said bearing surface, and ports to permit the oil to circulate through said sleeve; and means for agitating the oil to circulate through said sleeve.

Mineral Oil Composition—Patent #2,464,497—John J. Giammaria, assignor to Socony- Vacuum Oil Co., Inc.

A viscous mineral lubricating oil fraction containing a minor proportion, from about 0.1 per cent to about 5.0 per cent, of an oil soluble, coordinated metal complex characterized by the nucleus



wherein the group



represents an organic base characterized by two tertiary nitrogen atoms in the positional relationship shown; M is a metal selected from the group consisting of copper, mercury, aluminum, lead, cobalt and nickel; and A and A' are organic acid groups; said metal complex acting to stabilize the oil fraction against oxidation.

A Method of Producing a Mineral Oil Concentrate — Patent #2,465,221 — George R. Gilbert assignor to Standard Oil Development Co.

A method of producing a mineral oil concentrate of at least one compound of the class consisting of polyvalent metal petroleum sulfonates and polyvalent metal petroleum sulfonate-inorganic complexes, said complexes being prepared by reacting a solution of a polyvalent metal petroleum sulfonate with an aqueous solution of not more than one mol of a material selected from the class consisting of calcium chloride, calcium hydroxide, ammonium chloride, ammonium nitrate, and lithium hydroxide and evaporating the water therefrom, which comprises treating a mineral oil solution of at least one of said sulfonate containing compounds with a solvent of the type which has preferential solvent action on the aromatic components of a hydrocarbon mineral oil, whereby an extract phase and a raffinate phase are formed, separating the phases and removing the solvent from the extract phase, thereby yielding a mineral oil concentrate of the compound.

Insecticidal Spray Oil Containing Lecithin—Patent #2,465,335—Myron J. Burkhard, assignor to Socony-Vacuum Oil Co., Inc.

A spray oil for use in verdant spraying, comprising a moderately refined petroleum oil of from about 50 to 150 seconds Saybolt viscosity at 100°F., having an unsulphonatable residue not over about 80% and in addition thereto from about 0.05% to about 1.0% by weight of lecithin.

Stabilized Liquid Petroleum Hydrocarbon—Patent #2,465,902—John G. McNab and Dilworth T. Rogers, assignors to Standard Oil Development Co.

A liquid petroleum hydrocarbon product containing dissolved therein an amount sufficient to substantially stabilize said hydrocarbon product of a product obtained by reacting a sulfide of phosphorus with a polyvalent metal salt of a compound of the formula

$$Ar(OH)(SO_3H)(R)$$

where Ar is an aromatic nucleus containing not more than 12 carbon atoms, and R is an alkyl group of sufficient chain length to impart oil solubility to said reaction product, said salt having the hydrogen of the—OH and—SO3H groups replaced by metal, the proportions of said sulfide of phosphorus and said metal salt being such that from 0.05 to 2 atomic proportions of phosphorus are present for each atomic proportion of metal, and the reaction being conducted by heating the reactants together at an elevated temperature for a period of time sufficient to produce a reaction product which is substantially non-corrosive to copper.

Grease—Patent #2,465,961—Hendrik van Olphen, assignor to Shell Development Co.

A grease composition comprising a mineral oil lubricant, a metallic soap in an amount sufficient to gel said oil and form a grease structure and a substantially oil soluble monomeric glycol having at least 6 carbon atoms in an amount ranging from 1% to 10%.

Purification of a Fatty Oil—Patent #2,465,969—Jakob L. Jakobsen, assignor to General Mills, Inc.

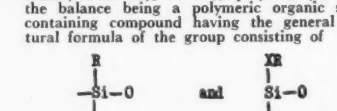
In the purification of a fatty oil selected from the group consisting of degummed soybean oil and degummed and alkali refined soybean oil, the step of heat stabilizing said oil, comprising subjecting the oil for approximately one hour to one hour and one-half to a temperature within the approximate range of 230-300°C., under vacuum, while blowing a substantially oxygen-free inert gas through the oil, the amount of gas being a small fraction of the weight of the oil.

Lubricating Composition—Patent #2,466,408—Charles Earle Funk, Jr., assignor to American Cyanamid Company.

Process for preparing a solution in lubricating oil of a heavy metal salt of an oil-soluble diester of dithiophosphoric acid which comprises the steps of adding an oil-soluble diester of dithiophosphoric acid to a dispersion in mineral oil of a divalent metal base selected from the group consisting of the oxides and hydroxides of calcium and zinc, said dispersion containing from about 0.1% to about 5.0% of water, reacting the acid and alkaline materials at a temperature within the range of from about 20°C. to about 90°C., and removing the oil-insoluble reaction salts by infiltration.

Metal Lubricant Compositions—Patent #2,466,642—Robert G. Larsen, assignor to Shell Development Company.

A lubricating composition consisting essentially of from 1% to 25% of a laminated foliated finely divided antiscoring agent from the class consisting of graphite, molybdenum disulfide, vermiculite, talc, tungsten, disulfide, zinc oxide, calcium oxide, mica, silver sulfate, and lead iodide; from 10% to 25% polyisobutylene, and the balance being a polymeric organic silicon-containing compound having the general structural formula of the group consisting of



and mixtures thereof wherein each R is selected from the group consisting of unsubstituted and substituted hydrocarbon radicals having less than 20 carbon atoms, each X is an atom selected from the group consisting of oxygen, sulfur, selenium and tellurium, and n is a positive interger of at least 2.

Lubricating Compositions — Patent #2,466,927—James Albert Burton, assignor to Graphol Products Co., Inc.

A lubricating composition for use in metal machining operations consisting of 100 to 125 parts of a petroleum lubricating oil, 1 to 16 parts of turpentine oil, 1 to 5 parts of com-

minuted graphite, 1 to 2 parts of iron oxide and 1 to 5 parts of carbon tetrachloride.

Metalworking Lubricant—Patent #2,467,137—Hollis L. Leland, assignor to Standard Oil Development Co.

A transparent sulfurized metal working oil consisting essentially of a mineral lubricating oil and a quantity sufficient to impart load bearing properties to said oil of a sulfurized fatty oil which has been sulfurized in the presence of 0.0005 to 5% by weight, based on the total compositions, of an alkylated phenol selected from the group consisting of tertiary octyl phenol and 2,6-di-tertiary butyl para-cresol, said metal working oil having an overall sulfur content between 1 and 15% by weight.

Lubricant—Patent #2,467,145—Arnold J. Morway and John C. Zimmer, assignors to Standard Oil Development Co.

A lubricant grease of solid consistency consisting essentially of 5% to 40% by weight of acetylene black incorporated in a substantially hydrocarbon-insoluble, inert fluorinated hydrocarbon mixture of 60 to 80% fluorine content by weight obtained by direct fluorination of a gas oil fraction.

Lubricant—Patent #2,467,146—Arnold J. Morway and John C. Zimmer, assignors to Standard Oil Development Co.

A colloidal lubricating grease composition substantially insoluble in hydrocarbon oils consisting essentially of a viscous unctuous mineral oil insoluble material selected from the group consisting of glycerin and petroleum insoluble non-drying glycerides of fatty acids, said material being thickened to a grease-like consistency by incorporation therein of about 11 to 18% by weight, based on the total composition, of acetylene carbon black.

Low-Temperature Lubricant—Patent #2,467,147—Arnold J. Morway and John C. Zimmer, assignors to Standard Oil Development Co.

A lubricating grease composition consisting essentially of an oily ester of the general formula $COOR_1—R—COOR_2$, wherein R is a bivalent aliphatic hydrocarbon radical and R_1 and R_2 are radicals selected from the group which consists of branched chain alkyl, alkaryl and cyclo alkyl hydrocarbon and substituted hydrocarbon radicals, said ester being thickened to a grease consistency of colloidal structure with a 5 to 25% by weight, based on the total composition, of a carbon black of abnormally high structure index as determined by high oil absorption and oil thickening capacity.

Oil Insolub'e Lubricant—Patent #2,467,148—Arnold J. Morway and David W. Young, assignors to Standard Oil Development Co.

A lubricating composition consisting essentially of 1 to 20% of acetylene black and 80 to 99% of an oily acrylonitrile-diolefin type copolymer composed of 76 to 55% by weight of diolefin of 4 to 12 carbon atoms and 24 to 45% of acrylonitrile, said copolymer being produced by copolymerization at a temperature of 25° to 70°C. in the presence of an aliphatic mercaptan having not less than 5 and not more than 16 carbon atoms per molecule, said copolymer having an intrinsic viscosity of between 0.05 and 0.4.

Solvent Extraction of Castor Oils — Patent #2,467,403—Michael W. Pascal, assignor to The Sherwin-Williams Co.

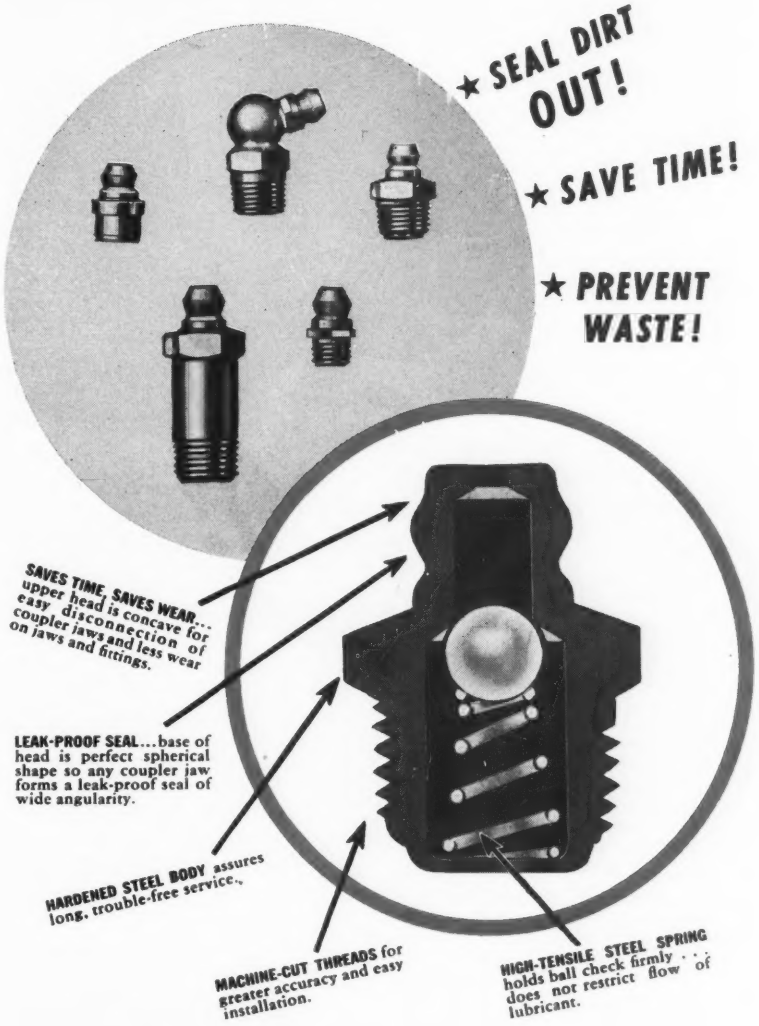
In the production of castor oil by solvent extraction, the steps of forming a miscella of castor oil and aliphatic hydrocarbon solvent therefor in a liquid state, said miscella having a temperature and a castor oil-solvent ratio located within the area to the right of the critical minimum miscibility curve for the said solvent and castor oil as characterized by the accompanying phase diagram, said solvent being maintained above the critical minimum miscibility temperature for the miscella during the formation of the miscella, cooling said miscella below the critical minimum miscibility temperature therefor, at which temperature the miscella becomes turbid, and allowing the misce'la to separate into an oil-rich phase and an oil-poor phase, and then withdrawing said oil-rich phase.

Lubricating Oil Composition — Patent #2,467,713—Franklin M. Watkins, assignor to Sinclair Refining Co.

A lubricating oil composition comprising a major proportion of a petroleum lubricating oil fraction, a minor proportion of calciub iso-octyl salicvlate, effective as a detergent, and an olefin sulfide in an amount sufficient substantially to deactivate the calcium of the calcium iso-octyl salicylate, said olefin sulfide being selected from the group consisting of mercapto olefin sulfides, diamylamino olefin sulfides and anilino olefin sulfides.

(*Continued on page* 154)

ARO Grease Fittings FOR EVERY NEED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Patent Abstracts

(*Continued from page* 153)

Lubricants—Patent #2,467,836—Eugene Lieber and Martin M. Sadlon, assignors to Standard Oil Development Co.

A lubricating oil composition comprising a major proportion of waxy mineral lubricating oil containing about .02% to 2.0% of each of two additives, one called a pour depressor and the other a pour sensitizer, said pour depressor consisting essentially of a Friedel-Crafts condensation product substantially non-volatile up to 600°F. under fire and steam distillation, of about 10 to 20 parts by weight of naphthalene with 100 parts by weight of chlorinated paraffin wax having a chlorine content of about 10 to 15%, and said pour sensitizer being a fraction having an average molecular weight of about 500, obtained by amyl alcohol extraction of substantially the same type of material as said pour depressor, said pour sensitizer being also per se substantially non-volatile up to about 600°F. under fire and steam distillation and having per se substantially no pour depressing properties.

Lubricant—Patent #2,468,031—Robert E. Burk and Everett C. Hughes, assignors to The Standard Oil Co.

A lubricant promoting combustion of deposits in the combustion zone of internal combustion engines and producing high stability in the crankcase, which comprises a lubricating oil and one-fourth to three per cent of the reaction product of phosphorus sulphide on degras and one-half to three per cent of chromium naphthenate.

Process for Breaking Petroleum Emulsions—Patent #2,468,180—Melvin De Groote and Bernhard Keiser, assignors to Petrolite Corp., Ltd.

A process for breaking petroleum emulsions of the water-in-oil type, characterized by subjecting the emulsion to the action of a demulsifier including a cation-active polychloride; said cation-active polychloride being the reaction product of diglycol chloroformate and an oxyalkylated imidazoline substituted in the 2-position by a radical containing 11 to 22 carbon atoms selected from the group consisting of alicyclic hydrocarbon radicals, aliphatic hydrogen radicals, and aliphatic hydrocarbon radicals, substituted by hydroxyl radicals; said oxyalkylated imidazolines containing a member of the class consisting of

and

radicals, wherein R denotes an alkylene radical having at least 2 and not more than 4 carbon atoms, and n is a numeral not over 10.

Lubricant Containing Pour Point Depressant—Patent #2,468,500—Eugene Lieber and Edward P. Cashman and Raymond M. Dean, assignors to Standard Oil Development Co.

The process of improving the pour point stability of a wax modifier made by an initial Friedel-Crafts condensation of about 1 to 5 mols of chlorinated paraffin wax containing about 10 to 20% of chlorine with one mol of a low molecular weight aromatic compound in the presence of an inert solvent, to make an initial condensation product having a molecular weight of at least 1000 and having wax modifying properties, comprising subjecting said initial condensation product to a further Friedel-Crafts condensation with an aryl polyhalomethane compound, hydrolyzing and removing the catalyst and distilling the reaction products under reduced pressure to at least 500°F. to obtain the desired condensation product as distillation residue.

Lubricating Oil Composition—Patent #2,468,501—Eugene Lieber and Aloysius F. Cashman, assignors to Standard Oil Development Co.

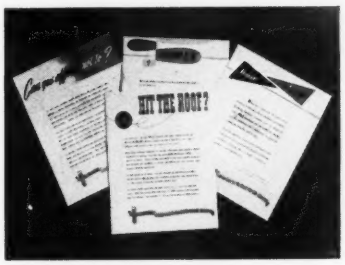
A lubricating composition comprising a major proportion of a waxy mineral lubricating oil, about 0.1% to about 2.0% of a high molecular weight condensation product of chlorinated paraffin wax and naphthalene, and about 0.01% to about 1.5% of a polymeric compound prepared by pyrolyzing a high molecular weight fatty acid chloride at about 400° to about 750°F.

Extreme Pressure Lubricating Compositions—Patent #2,468,520 — Lorne W. Sproule and Laurence F. King, assignors to Standard Oil Development Co.

A lubricating composition consisting essentially of 70 to 95 parts by weight of mineral oil, 1 to 15 parts of a halogenated hydrocarbon wax, and a quantity sufficient to substantially inhibit corrosiveness toward metals of the reaction product of 60 to 120 parts by weight of sperm oil, 10 to 30 parts of sulfur, and ½ to 2 parts of a sulfide of phosphorus heated to a reaction temperature of 250° to 450°F. for a period sufficient to effect substantial completion of reaction.

New Products and Equip.

(*Continued from page* 141)



FILTRATION BOOKLETS

A set of four two color booklets published by Honan-Crane Corporation gives the complete story on the value of filtering oils and coolants used in metal working operations such as, cutting, grinding, boring, honing, quenching etc. The four booklets discuss:

1. The tremendous dollar savings in man hours, lower operating costs and higher production.

2. How to solve problems of dermatitis, excessive rejects, coolant disposal, machine downtime.

3. How to do it—the right method and equipment to handle any problem from 1 to 500 machine tools.

This set of booklets is available by writing Honan-Crane Corp., 818 Wabash Avenue, Lebanon, Indiana.

NEW TRADE ASSOCIATION

An active campaign to enlarge its membership is being inaugurated by the Independent Oil Compounders Association, which was organized in May, 1948. This young organization now reports a membership of 32 active and 17 associate members, scattered over the country from coast to coast. Mr. L. F. Paape of the Filmite Oil Corp., Milwaukee, the Association's first President, states that he believes they are now ready to offer Independent Oil Compounders of the nation a really effective trade association program. The Board of Directors consists of 15 members geographically located throughout the country. Two monthly bulletins are issued containing news of trade and association activities. The Chairman of the Membership Committee is Dan Riley of Riley Bros., Inc., Burlington, Iowa. Association headquarters are located at 125 E. Wells St., Milwaukee 2, Wisc., with H. L. Ashworth as Executive Secretary.

NEW ARO DISTRIBUTOR

The Aro Equipment Corporation, Bryan, Ohio, announces the appointment of The Aro Sales & Service, Inc., as its distributor for Aro products on the Pacific Coast.

A newly formed California corporation, it will act as the sole distributor for Aro products in the States of California, Washington, and Oregon. Headquarters will be maintained at 2023 South Grand Avenue, Los Angeles 7, Cal. The office in San Francisco is located at 766 Brannan Street. Sales and service for the Pacific Northwest will be handled by the Pratto Sales Company, at 714 Fouth Avenue, Seattle, Washington.

Adequate stocks of all Aro products, as well as repair parts, will be maintained at all three locations.

Assigned to each branch will be competent factory trained service engineers who will be in charge of completely equipped service departments. In addition, factory trained field service engineers will be in constant contact with all users of Aro equipment.

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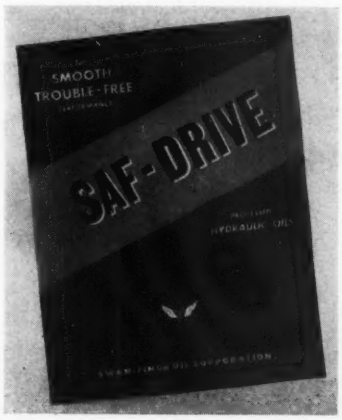

Silicone News
DC SILICONES

DC 33 Silicone Grease for Permanent Lubrication of Synchronous Motors

Several years of continuous service without maintenance are required of the kilowatt demand meters and time switches used by electric utilities. These devices must give accurate and reliable service whether they're installed in the North where temperatures drop to—40° F. or in the South where internal temperatures reach 180°F. These requirements are met by using a silicone lubricant for the bearings in hysteresis type synchronous motors designed for high torque, self-starting, low speed operation.

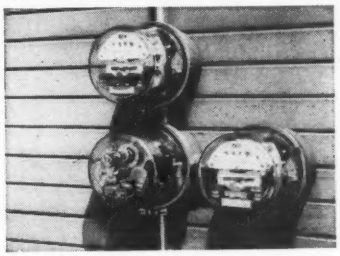

PHOTO COURTESY SANGAMO ELECTRIC COMPANY

DC 33 Silicone Grease retains its consistency to permit timing motors in demand meters and time switches to operate at constant speed in spite of varying climatic conditions.

Sangamo engineers specified DC 33 Silicone Grease for the bronze sleeve bearings of these small synchronous motors after extensive comparative testing. Their tests proved that DC 33 was superior to any other lubricant for this application because it is practically non-volatile, heat-stable, and because it has low torque at low temperatures. Final proof is the fact that thousands of these little motors have given faultless service ever since Sangamo started to use DC 33 Silicone Grease over 3 years ago.

In oven and toaster timers, parking meters, wind velocity indicators and in the permanently sealed bearings of industrial motors Dow Corning Silicone Oils and Greases have made permanent lubrication a practical reality. You can obtain more information about Dow Corning Silicone Greases from our nearest branch office or by writing for data sheet No. D5P6.

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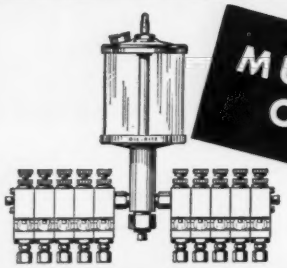

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Oil-Rite's Multiple Oiler offers you dependable and economical gravity drop feed oiling to multiple points. It makes inspection and servicing of a number of oilers possible from a single station, replacing up to 24 individual oilers.

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Write for Bulletin

Available in many body sizes from 9 oz. to 1 gal. and up to 24 feeds depending on your requirements.

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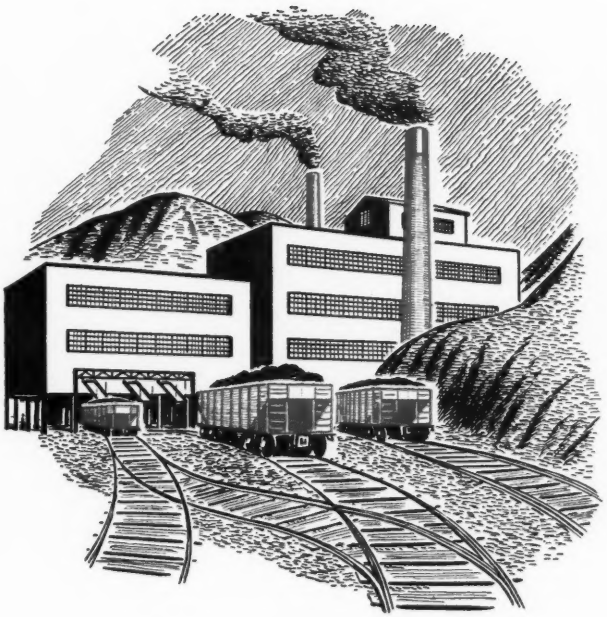
World's largest tipple is completely equipped with Farval

THE world's largest coal cleaning plant is being equipped with Farval Centralized Lubrication. Two automatic and eight manual systems will serve more than 700 points of lubrication.

This is the fourteenth modern tipple to be Farval-equipped since the war. Noteworthy among other recent installations are one at the world's largest coal mine, in Pennsylvania, and one at a Kentucky mine operated by the world's largest coal producer.

The benefits of Farval are fourfold—oiling labor is saved, lubricant is saved, bearing expense is saved, and most important of all, production time is saved. In one plant, for example, the lubrication of 431 bearings with Farval takes only 10 minutes a day—a job that would require at least 10 hours if done by hand. In another plant, Farval saves $34 a day by eliminating one oiler per shift. In still a third tipple, with Farval a less expensive grease can be used on eccentric bearings, with resultant saving in lubricant alone of $100 a month.



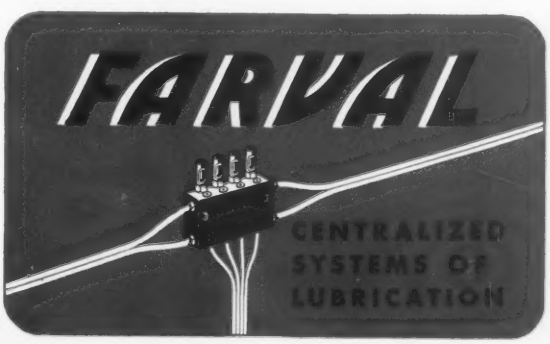
Farval centralized lubricating systems have been serving the coal industry for more than 17 years. In preparation plants, Farval lubricates Feeders, Crushers, Conveyors, Shakers, Screens, Elevators, Washers, Jigs, Dryers, Mixers, Loading Booms and Drives.

Farval has proven itself in over 20 years of service. It is the original Dualine system of centralized lubrication that others imitate. The Farval valve has only 2 moving parts—is simple, sure and foolproof, without springs, ball-checks or pinhole ports to cause trouble. Through its wide valve ports and full hydraulic operation, Farval unfailingly delivers grease or oil to each bearing—as much as you want, exactly measured—as often as desired. Indicators at every bearing show that each valve has functioned. For a full description, write for Bulletin No. 25.

FARVAL—*Studies in Centralized Lubrication*
No. 102

The Farval Corporation, 3267 E. 80th St., Cleveland, O.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.



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